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An Appeal to Congress

SENATORS and Representatives, you are about to decide whether or not America is to have a merchant marine.

The situation is this; with the exception of the four freighters recently purchased by Captain Robert Dollar, there is not a privately owned American vessel operating in the trans-Pacific trade between America and Asia. Captain Dollar with all his experience is in doubt as to whether he can successfully operate his new ships but he is going to do his best. If Captain Dollar does succeed in making a go of his American ships under existing conditions, it will be largely because he is a trader as well as a shipowner. He can send his vessels out filled with lumber from his own mills. When one of his vessels lacks a return cargo he purchases copra or some other commodity for his own account and, still further, he runs a feeder service for 1,600 miles up the Yangtze River. Captain Dollar with his large resources might be able to mix a few American vessels with the ships that he operates under foreign flags but without some inducement from the Government, the Pacific Ocean, which is destined to become the center of the world's commerce, will remain bare of privately owned American ships.

Turning to the Atlantic, we find that with the exception of the passenger and cargo ships operated by the United American Lines and the International Mercantile Marine Company there are very few *privately* owned American ves-

sels in the transatlantic trade. Take away the vessels owned by the Shipping Board, the vessels owned by the companies which carry their own products, such as the Standard Oil, United States Steel and United Fruit, and our merchant marine today is no farther ahead than it was in 1914.

This is an appalling situation. The Shipping Board is maintaining today about 70 services covering every trade route known to be of any value but it is doing it at a tremendous cost to the Government. Without the direct and indirect aids proposed by the President, or some equivalent, the Government will be compelled to operate these routes or see them abandoned. The two years that have elapsed since the passage of the Jones Act have demonstrated that, unless some reasonable degree of national aid is assured, private initiative and private capital cannot be interested in these routes which are necessary to protect our overseas trade.

After all, it is the foreign trade in which the country is primarily interested. American ships are but one of the means for promoting this trade but no one can gainsay that the farmers, manufacturers and merchants of this country will receive far more loyal, regular and expeditious service from American ships than they will from the vessels of a country which is our competitor in trade and our possible enemy in war. Every great maritime country in history has spared neither effort nor expense to secure the carriage of the greater part of its sea-borne commerce in its own ships manned by its own men for in no other way can it be certain of the delivery of its goods or of protection in war.

Higher construction costs, higher operating expenses, the probable disposition that will be made of the Shipping Board vessels, together with the experience and established banking, insurance, and merchandising facilities possessed by our competitors have prevented private capital from investing in shipping. These factors will continue to prevent the private ownership of American vessels until capital is assured that Congress will provide reasonable aid until such a time as our shipping is established on a sound and permanent basis.

The enactment of the Shipping Bill which the President has recommended for your consideration will assure the re-establishment of our merchant marine and the retirement of the Government from the ship operating business, which will change the Shipping Board vessels from a liability to an asset. We cannot go on as we are for it is impossible for the managers of Government-owned vessels to feel the same interests or assume the same responsibilities that they would in their own vessels. On the other hand, there is an inherent fear on the part of business men against doing any

American Marine Association Backs Shipping Bill

WHEREAS, the American Marine Association is an organization composed of concerns and individuals identified with the building, repairing and operation of ships and the manufacture of those things with which ships are equipped, and therefore vitally interested in any movement which makes for a real American merchant marine; and

WHEREAS, the President of the United States, both before and since his election, has emphasized the necessity for an ample merchant marine and pledged the country to that end insofar as it lay within his power to so do; and

WHEREAS, following a recent message from the President urging early action, there were introduced in the Congress two bills, designated S 3217 and HR 10644 respectively, both designed to provide legislation which will make it possible for merchant ships flying the American flag to both successfully compete with foreign owned vessels and insure to America the maximum of trade with foreign countries so vital to the welfare of the whole nation; and

WHEREAS, the said bills S 3217 and HR 10644 are based on recommendations of the United States Shipping Board made after exhaustive studies of ways and means of building and perpetuating a merchant marine that will best serve America's interests, be it

RESOLVED, that the American Marine Association hereby endorses bills S 3217 and HR 10644 now before the Congress of the United States and urges their early passage.

FURTHER RESOLVED, that the Secretary be and hereby is instructed to send a copy of this Resolution to each and every member of the Congress, to the press and to such other individuals and organizations as should be informed of our action.

business with an organization that savors of Government ownership.

Gentlemen of Congress, you are about to pass a tariff bill designed to protect the manufacturer and the farmer. Can you consistently refuse to grant to the merchant marine the same form of protection that has developed our other industries?

Marine Insurance Rates

"THE three great elements which constitute the fabric of Foreign Commerce," said Mr. Charles R. Page of the Firemen's Fund Insurance Company in his address before the Ninth National Foreign Trade Convention, "are ocean transportation, marine insurance and banking credits."

In discussing the factors upon which marine insurance rates are based Mr. Page pointed out that "it is perfectly obvious that the operator of the American ship cannot successfully compete for cargo as against the foreign ship, if the shipper must bear increased costs for shipment by American vessels. It is also true that in the past underwriters generally have maintained differentials, not against American ships, as such, but against Shipping Board owned and operated tonnage. For this alleged discrimination it is the underwriter's belief that there has existed ample justification.

"Happily, however, these conditions are passing. The Shipping Board has very wisely called practical shipping men into its service. It has cut the number of its operating agents in half and has retired from active service all but the best of its ships. This is rapidly bringing about the elimination of the differentials against Shipping Board vessels, as such, and has laid the foundation for a cooperative effort between the board and the underwriters to establish parities of rating with competitive lines so far as may, upon impartial investigation, be justified by facts.

"American cargo underwriters stand ready to do their part in the development of American lines and to grant to our ships equal rates for equal conditions of management and tonnage, and equal record of immunity from disaster. They cannot, however, be justly asked to grant equality of rating, if the record shows physical inferiority of tonnage, or in-

efficiency and inexperience of management, or records of mishaps that overshadow like records of the operations of their competitors. Neither can any other scheme which is calculated artificially to equalize or sweep away disabilities that actually exist, and which ignores sound economic principles established by actual experience, be in the long run other than detrimental to the establishment of our merchant marine on a sound and lasting basis."

In the above statements Mr. Page has given a very important reason for the immediate passage of the Shipping Bill for a differential in marine insurance rates might easily become a greater handicap than the lack of a subsidy. The Government aid proposed in this bill or its equivalent must be obtained, if private operators are to be induced to take over the Shipping Board vessels. The longer the Government is compelled to operate the trade routes that the Jones Law requires where the operating expenses are paid by the board, the more demoralized and inefficient will become the officers, the crews and the managements. The inevitable result of continued Government operation will bring about such a state of inefficiency that the majority of American operators will never be able successfully to operate American privately owned ships on a businesslike basis.

Why Handicap Common Ownership of Cargo and Vessel?

THE exclusion of American vessels from the benefits of the Shipping Bill where there is common ownership of vessel and cargo unless one-third of the capacity of the ships is available for common carriage for ten days preceding sailing dates is wrong in principle and cannot possibly result in a saving to the nation.

It is quite true that the United States Steel Corporation and the Standard Oil Company can easily exist without a subsidy from the Government but neither of those companies nor the Government itself can change fundamental economic laws. The fact that the cost of operation of a vessel varies directly as the cost of living in the country whose flag it flies is not influenced by the wealth or poverty of a vessel owner ought to be evident.

Of course a powerful concern supported by its domestic

Society of Naval Architects and Marine Engineers Indorses the Shipping Bill

RESOLVED, that the Society of Naval Architects and Marine Engineers, at a special meeting held in New York on May 19, 1922, having discussed the bill now pending before the Congress of the United States, known as "A Bill to Amend and Supplement the Merchant Marine Act, 1920, and for other purposes" desires to go on record as heartily favoring the early enactment of this measure into Law.

This Society considers it of vital importance that our country place itself in a position to carry its surplus products to competitive foreign markets in ships owned in America and of American registry, as a matter of prudence and economy in time of peace and as a measure of national defense in time of war.

Be it further resolved that a copy of these resolutions be forwarded to the President of the United States and to the Senate and House Committee having jurisdiction of the pending measure.

business could continue to run its ships under the American flag but it would have to sell its products in foreign markets in competition with goods carried in cheaper ships which could only mean that the difference would have to be made up in the price paid by the domestic consumer. If the "private owner" is to be discriminated against in the forthcoming legislation, it is to be hoped that he will retain his vessels under the American flag without the public being compelled to pay an excessive indirect subsidy.

But there is more probability that these large concerns, and almost a certainty that the smaller concerns, will consider it the better way to transfer their vessels to a foreign flag. If they did, it would mean, in oil tankers alone, a loss to our merchant marine of approximately 40 percent of the privately owned tonnage.

To permit this tonnage to pass out of our hands is to admit that the merchant marine is of no importance as a naval auxiliary; for what could the Navy do, or the greater part of our merchant ships for that matter, without an assured supply of oil fuel? Is it not, with the American people, more a question of an adequate merchant marine than a case of nullifying the efforts of those who have set the example which we all hope America will follow, which is to carry its own products in its own delivery wagons?

A Wise Decision

THE decision of President Harding to let the *Leviathan* remain the *Leviathan* is to be commended. The war name of this famous vessel that carried thousands of American soldiers to and from the battlefields of France should never be changed. Doughboys all over the country will watch its career as the finest passenger ship afloat and the sentiment and pride that they hold for the great ship which was their home through the dangerous submarine zone should be respected.

West of the Appalachian mountain range the *Leviathan* is probably the only American passenger ship that is universally known. Those who travel to Europe from Middle West towns will want to tell their friends when they return that they sailed at least one way on the famous *Leviathan*. Her name, like any well-known trade name, will have a

distinct advertising value not only for herself but for the whole American merchant marine.

But the *Leviathan* cannot maintain an express passenger service alone. The White Star Line and the Cunard Line have three giant express steamers each. Why not show the world that America can build a passenger ship that will be second to none and let that vessel take the name of the man under whose administration the American merchant marine will be reestablished—President Harding?

History's Greatest Industrial Achievement

WITH the delivery of the 535-foot passenger and cargo ship *Western World* to the Shipping Board on May 9, not only the greatest shipbuilding program but also the largest industrial achievement in the history of the world was completed. The Shipping Board has been the butt for acrimonious criticism of all sorts; it has been accused of scandalous inefficiency but little has been said of its accomplishments for which the future is bound to give it credit.

Since the *North Bend* was turned over to the Government on May 24, 1917, the board has constructed 2,312 vessels of many different types and of 13,636,711 deadweight tons. These vessels, if placed in a straight line, stem to stern, would extend for a distance of 158 miles and, if steaming a mile and a quarter apart, would reach from New York to Southampton, England. The total deadweight tonnage is equal to the carrying capacity of 388,363 freight cars loaded 35 tons per car.

A still more striking comparison may be made of the power generated by the propelling machinery. Colonel W. P. Wooten, Corps of Engineers, U. S. A., figured that the development of the Great Lakes-St. Lawrence Waterway would deliver 1,464,000 horsepower at the switchboard. The total power that could be developed by the vessels constructed by the board is 4,593,000 indicated horsepower or over three times the amount that we could expect from the St. Lawrence.

To construct this enormous tonnage with adequate shipbuilding facilities would have been a big task but at the beginning of the program there were only 50,000 first class

mechanics available in our shipbuilding industry. It was necessary to expand this number by intensive training to 385,000 men proficient in the trade of building ships. It was necessary to give aid financially and otherwise to 179 yards for plant construction and again it was necessary in carrying out this stupendous project to build 13 marine railways, 17 floating docks and 2 graving docks.

The result of this shipbuilding program has been obscured by the impossibility of efficiently operating vessels under Government ownership but nevertheless our increased share in the carrying trade of the world has been the means of marketing billions of dollars worth of our products when ships were scarce. In 1914 commodities to the value of \$368,359,756 were carried in our own ships representing 9.7 percent of our water-borne foreign trade whereas in the fiscal year beginning June 30, 1920, this percentage was increased to 44.8 percent and the value of the imports and exports carried in American bottoms amounted to \$5,071,905,981.

Of course no one will challenge the fact that the board and its agencies hold a record for building ships that never has and probably never will be equalled but how many realize what a tremendous industrial undertaking it was? How many realize the daily decisions involving millions and sometimes hundreds of millions that had to be made? How many know that the board had to take the duties and responsibilities of a banker, to become a general contractor providing shipbuilding facilities, to become a manufacturer, increasing the output of ship equipment, to become a lumber merchant, acquiring timber forests, to become an insurance company selling protection? How many know that it built and operated street railways, constructed and operated hotels for housing workmen, homes for the families of workmen, in fact whole towns with paving, water, gas, sewers, theatres and hospitals? Those who know this and the many other things that the board and its agencies accomplished will acknowledge and history will record that the greatest shipbuilding program was also the greatest industrial project.

The Hague Rules

ONE of the important subjects of vital interest to all branches of the maritime industry which was discussed at the Ninth National Foreign Trade Convention was *The Hague Rules*. As everyone knows, every nation has different laws relating to ocean carriers. In our own country the regulations printed on the bills of lading issued by our steamship companies are so long and complicated that it not only takes a long time to read them but they are beyond the understanding of the ordinary man. In addition to this, every steamship company has its own form and some of them several forms which are subject to change overnight. This has caused constant friction between the shipper and the carrier because the shipper has never understood his rights and where losses have occurred the shipper has in practically every case found that he has no right of recovery.

"An International Code is needed," said Mr. Charles S. Haight, in addressing the convention, "because so long as the law remains different in every country, you cannot stand-

ardize your forms, nor correct the evils which exist today. Even where changes are admittedly needed, no one nation will act alone, if by so doing its own shipowners will be placed at a disadvantage. As in our Disarmament Conference, all must act together, or no one will act at all."

These rules, which were drafted at The Hague last August by a committee composed of shippers, shipowners, underwriters and bankers, are really a codification of our own Harter Act with three important additions: First, they increase the carrier's liability from \$100 to £100 per package; second, they allow the shipper twelve months to present any claim for damage and to bring suit; third, they shift the burden of proof, in cases of pilferage and several other kinds of losses, from the shipper to the carrier, requiring the carrier to prove that the loss did not occur through the fault of himself or his employers.

According to Mr. Haight, these rules if universally adopted will benefit the shipowner, the cargo underwriter and the banker as well as the shipper. The shipowner will be benefited because he will not have to face the complications of different laws in every country, the present irritation will be removed and all carriers will be affected alike. The cargo underwriter will be able to fix his rates with definite reference to known risks and the banker will have a safer bill of lading and, by making the collateral safe, business will inevitably be facilitated.

It is a remarkable thing that the principal opposition to the rules in this country comes from the Chicago packers. The packers want the carriers to be responsible for each package up to its market value and they also want to make them responsible for errors in navigation or in the management of the ship. To do so, would of course cause the freight rate on every package to be determined by its value rather than by its size or weight. This would cause endless confusion and prevent the adoption of a set of rules which would have worldwide uniformity.

However, as Mr. Haight stated, "the rules are actually in force in Europe today. All of the great lines of the North Atlantic Conference are issuing bills of lading governed by the rules to shippers of cargo moving to the United States. The American shipper, however, cannot receive the benefit of the rules until the Harter Act has been changed. Under the law, it is provided that a carrier who issues a bill of lading in violation of the Act shall be subject to a fine of \$2,000 for each bill issued. Even though the points of conflict between The Hague Rules and the Harter Act are of comparatively little importance, a carrier cannot be asked to incur the risk of such a penalty by issuing a bill of lading in this country which is in conflict with the Act."

For the information of our readers, a bill has been introduced in Congress which is a short enabling act; it provides that a bill of lading under The Hague Rules shall be lawful, any provision in our statutes to the contrary notwithstanding.

A summer meeting of the Institution of Naval Architects of London, England, will be held in Paris, France, July 4 to 8 inclusive. Papers will be read on the mornings of July 4, 5 and 6, the afternoons being devoted to sight-seeing, receptions and visits to industrial works.

Ship Subsidy Is a "Trade Subsidy"

Marketing Our Excess Products of Farm, Mine and Factory Is Basic Object for American Merchant Marine

By "Old Scotch"

PRESIDENT HARDING has but recently been quoted in the daily press as saying that the merchant marine problem is perhaps the greatest confronting his Administration and that, if the proposed legislation—that is, the pending Subsidy Bill—fails of passage, the retrogression of the United States as a great nation may be expected to follow without fail.

In all of his many patriotic utterances, no greater nor more vital truth has ever been expounded. That is the very essence of this entire subject. The hearings thus far have, singularly enough, been far afield from the point at issue. All the testimony and discussion have been confined to the restricted phases of the proposed legislation. Wages of seamen, sale prices of ships, building costs, operating expenses, etc. are all relatively minor subjects compared with the great underlying principle involved in this pending legislation. One of the contemporaneous writers on the subject rightly used a term in a recent article, which seems to fit the subject admirably. It is not a "Ship Subsidy," said he, but in reality a "Trade Subsidy" for the United States.

WHAT A MERCHANT MARINE IS FOR

The basic object of a merchant marine for America is not the mere possession and operation of ships as common carriers for the whole maritime world, such as England's for example, but for the marketing of our excess products of the farm, mine and factory. We have no aspirations, either expressed or implied, for conducting a merchant marine as a basic industry, as we have already a sufficient diversity of occupations to keep our citizens well employed without going afar on the oceans of the world to seek business of that kind. All we want and need at this time is to round out and develop our existing industrial enterprises by providing, under our own flag and direction, every function which goes toward a complete system. We must treat all the industries of the United States as one great undertaking of which the people of this country are the stockholders. No industrial enterprise of any description can be said to be complete, unless it owns and controls its own delivery systems.

So far as our national enterprises are concerned, we are an isolated community with the great oceans surrounding us. The foreign trade which we have with contiguous territory, served by railroads and other land means of conveyance, is negligible compared with what we should and do have with countries reached only by ocean highways. If we do not have the vehicles for delivery of our goods over these ocean highways, we cannot, in times of keen competition, represented by normal world conditions, expect to transact our business of selling in competitive markets across the seas. The very people we must compete with own their own ships or delivery systems and it is fatuous for us to delude ourselves into thinking for a moment that they will carry our own goods at such rates or in such manner that we will be able to sell our goods in these competitive markets.

If we do not have any foreign trade and can consume all we produce here, there will not be any need for our having ships at all, except a sufficient number to act as auxiliaries for the national defense. But no one claims that we do not have to engage in foreign trade to dispose of our surplusage of goods. It is so elementary a fact that all recognize it. Why then should there be any controversy whatever over the necessity for having our own means for delivering these goods

to our customers? The only reason the American people need a merchant marine at all is in connection with the disposal of our national productions, hence why argue over the fact that the Government, for the best interests of all concerned, must by some such means as proposed in this subsidy bill make up the difference in the cost of operation of the ships by our own people?

A MISTAKEN CONCEPTION

Some editorials in supposedly American papers have had the hardihood to re-announce that moth-eaten dictum, that it is not a good economic policy to build up one industry at the cost of others. Such propaganda is the most veritable buncombe. We are not attempting to build up an industry, as such, but merely providing proper and necessary facilities to conduct all our other industries. All avocations share in the benefits of shipping alike. The number of people who would be employed in building and operating a sufficient fleet of vessels to conduct our American ocean-carrying business is entirely negligible when compared with any other of our great basic industries.

The necessary number, comparatively small as they may be, who will engage in shipbuilding and ship operation, must be American citizens and, as such, are entitled to just as good living conditions as all other citizens who use the same degree of skill in their various callings, and no better. To attain that standard of living in a trade primarily of national importance, these people must compete in a wide open field of endeavor with all the people of the world at large. No other American industry has to be thus handicapped, and people engaged in shipping and its allied industries have an inherent right to be placed on an equality of opportunity with all other branches of industry in this country.

ENORMOUS INCREASE OF OUR EXPORT TRADE

Under the direct operation of steamship lines, or delivery systems, through the medium of the vessels belonging to the United States Shipping Board our export trade has increased enormously over conditions which existed in pre-war times, or would have been obtained if we did not have these ships in operation at this time. True they are now being operated at a loss to the Government of approximately four million dollars per month. Place it at \$50,000,000 per year and what is that compared with a foreign trade amounting, even now in a period of great depression, to three or more billions of dollars annually? Does any one imagine for a moment that, if the United States had had no ships of its own at the time the armistice was signed, we would have exported anything like the immense amount of goods abroad we have sold in the last four years? Is there, or can there be, any better demonstration that the money lost in ship operation is a "trade subsidy" rather than a "ship subsidy?"

No shipowner is going to grow rich, if this subsidy bill is enacted, as the terms of the bill will so regulate it that but fair returns may be received by Americans who operate the ships to help our trade. Any industry must be operated at some profit, or who would be found to engage in it for glory alone?

WHY OUR TANKERS SHOULD BE PROTECTED BY SUBSIDIES

Some criticisms have been indulged in by opponents of the bill that great concerns, such as the Standard Oil companies

which own and operate their own ships, would be benefited under the terms of the bill. Why shouldn't they be benefited? There are but a very few commodities, which our modern living methods demand, more essential to our peace, comfort and protection than petroleum and its products. A world wide battle is now being waged among the great nations for control of this highly essential fuel. Nationally we are doing nothing to protect the interests of the American people, despite the fact that foreign governments are doing everything possible to gain control of the undeveloped oil-bearing areas which yet remain. It has been predicted by numerous well-informed writers that in another decade we Americans, to satisfy our unsatiable demand for gasoline and other petroleum products, will be buying them from our principal competitor for world eminence. The only organizations which stand between us and such a condition are our great and powerful oil companies. They should, therefore, be protected and encouraged in every legitimate manner by the Government.

What of it, if they should make large sums of money? Any citizen, at all provident, can invest his savings in the shares of these companies and partake of any profits they can make. Unless such organizations can make money, they will not be able to compete with foreign companies aided by foreign governments in obtaining new oil lands. If their ships engaged in carrying oil cannot be operated successfully under the American flag, they quite naturally will be transferred to alien flags and employ aliens at the lower wages to which they are accustomed. We would lose not only the money paid to their crews, which at best is a small matter, but we would lose a great national asset. Wars nowadays are as dependent upon petroleum as they are upon explosives and without an enormous fleet of oil carriers under the American flag we would be in a sad predicament. It must be kept in mind that every oil tanker under our flag is a national asset for defense of the nation. The small amounts proposed to be paid to their owners, as prescribed in the subsidy bill, will barely be sufficient to make up the difference in the cost of operation under the American flag. By all means there should be no restrictions placed upon them by the Government, such as compelling them to offer one-third of their tank space to the public, as proposed in the bill.

Therefore, Mr. Congressman and Mr. Senator, who will soon be called upon to vote on this bill, do not let petty

political prejudices interfere with your good judgment. Consider this measure as the great broad national question, which it undoubtedly is, and do not let it ever escape your consideration that its passage will not only make national prosperity possible and probable in times of peace, but that in addition it will add greatly to our safety in time of war when we cannot borrow the equipment of our rivals to fight our battles on the sea, land and air.

Established English Liner Companies Were Able to Make Good Showing in 1921

A STUDY of the reports of the net profits of nine important passenger and freight-carrying English liner companies for the years 1920 and 1921 would indicate that the financial position of the best known companies is nowhere near as bad as the gloomy reports that we have received would make it appear.

In the subjoining table of the profits of these companies and their allocation, it is to be noted that, except where otherwise stated, the profits are shown net after deduction had been made for depreciation, taxation, sinking fund, directors' fees and auditors' remuneration. The net profits for 1921 were 87 percent of those for 1920 and the amounts paid out for dividends were as much as 90 percent of those similarly distributed in 1920. The average rate of dividend, however, ranged from 12.3 to 17.9 percent less. The ratio of profits earned to capital invested, which for these companies is about £15,692,000, was 11.4 percent for 1920 and 10 percent for 1921.

As a further optimistic indication, the report of the Cunard Steamship Company, which is not included in the table, shows that that company made more money in 1921 than it did in 1920.

That shipping investments in Great Britain, when securities are offered by sound financial companies, are received with popular favor is shown by the fact that the Peninsular and Oriental Steam Navigation Company was able to float £3,500,000 of 5½ percent debentures about the middle of March. The issue was over subscribed in less than an hour. The Lamport and Holt Company was also able to float a similar issue for £2,000,000 a week later.

Company	Year Ending	Net Profit £	Ordinary Dividend and Bonus %	Amount Available £	Appropriation			
					Dividends £	Reserves £	Other Ap- propriat'ns. £	Carried Forward £
British India Steam Navigation.....	Sept. 30	1920 162,710	18.6	184,898	159,436	.....	.....	25,462
		1921 111,609	11.4	137,072	111,576	.....	.....	25,496
Cairn Line	Dec. 31	1920 106,816*	14.3	182,938	120,000	.....	.....	62,938
		1921 70,617*	10.0	133,555	120,000	.....	.....	13,555
Wm. France, Fenwick	Dec. 31	1920 149,697	21.4	162,294	120,750	28,211	.....	13,333
		1921 84,441	10.0	97,774	83,250	.....	.....	14,524
Houlder Line	Dec. 31	1920 64,831	14.3	67,626	26,125	25,000	.....	16,501
		1921 61,130†	10.7	63,881	33,000	.....	.....	30,881†
Lamport and Holt	Dec. 31	1920 301,871	10.0	402,338	212,841	75,000	14,000	100,497
		1921 314,665	8.0	415,162	213,000	50,000	15,000	137,162
Leeds Shipping	Aug. 31	1920 46,350	14.3	46,350	40,000	.....	.....	6,350
		1921 53,934	.....	60,284	.....	50,000	.....	10,284
Orient Steam Navigation	June 30	1920 197,434	21.4‡	261,346	92,668	100,000	.....	68,678
		1921 196,642§	17.9‡	265,320	144,713	70,440	.....	50,167
P. and O. Steam Navigation	Sept. 30	1920 657,377	21.4	772,607	660,668	.....	.....	111,939
		1921 571,467	17.1	683,405	583,100	.....	.....	100,305
Rowland and Marwood's Steamship ..	July 31	1920 109,809	25.0	161,636	55,025	55,040	.....	51,571
		1921 99,595	25.0	151,166	55,025	22,000	.....	74,141
Total		1920 1,796,895	17.9	2,242,033	1,487,513	283,251	14,000	457,269
		1921 1,564,100	12.3	2,007,619	1,343,664	192,440	15,000	456,515
1921 totals compared with those of 1920.....		1920 100		100	100	100	100	100
		1921 87.0		89.5	90.3	67.9	107.2	99.8

* After deducting in 1920 £40,000 and in 1921 £100,000 for depreciation. † Subject to Income-tax and other charges. ‡ On Deferred Shares. § Excluding £50,000 transferred from Underwriting Account and £2,479 discount on Debentures redeemed.

Joint Hearings on Shipping Bill Concluded

Chairman Greene Says Lengthy Examination Breaks Record for Consideration Given Any Bill That He Can Remember

THE joint hearings on the Merchant Marine Act of 1922, which closed on May 19, are remarkable from many angles. The amount of information included in the voluminous records of these hearings is enormous. Anyone who will take the trouble to procure and study them will be assured of a liberal education on shipping and ship-building matters.

Outside, however, of the expert testimony presented by the leading shipowners, operators, builders and marine authorities, the hearings were distinctly different from those on former bills designed to aid shipping in the interest shown by commercial and industrial organizations. The endorsements of the President's plan that were received from such organizations in the South and the Middle West are ample proof of the fact that the interest in an American merchant marine is no longer confined to the seaboard. Of particular significance was the endorsement of the American Farm Bureau, and the testimony of Mr. J. R. Howard, its president, before the joint committee.

SHIPS CONTROL TRADE

"Ships, in the last analysis, are nothing but the delivery wagons of trade," said Mr. Howard. "The nation which controls these delivery wagons controls a service which produces satisfied customers, increased orders, and an ever-widening circle of prestige. If the other nation controls the ships which carry our products, we shall never be able to reach the markets when the price is best. The other nation will use the ships then; we may when he does not want to."

"The British are today furnishing a service from New York to Brazil. This service is slow, requiring about 14 days, and taken care of by old boats. We can hardly expect better service than this to carry our typewriters, harvesters, plows and a thousand and one other articles to South America unless we do it ourselves. The speed is held down to the service afforded from Great Britain. We shall never build up a fast, satisfactory service on British third or fourth rate vessels. Yet it is upon this fast service which develops rapid mail communication that trade depends and the illustration of the service between United States and South America might be multiplied in other directions. We cannot rely upon others to give the service necessary to build up this trade. If it is to be done, America must do it herself and I am sure we all want it done."

WHY THE FARM BUREAU BELIEVES THE UNITED STATES NEEDS A MERCHANT MARINE

Mr. Howard called attention to the following reasons for an American merchant marine:

"1. The United States is no longer a debtor but rather a creditor nation and must seek the business.

"2. Other nations will be competing in Europe where we market our goods. We must be prepared to put our products into the European market promptly and cheaply.

"3. Transportation, the servant of business, must be

available when needed; it will be available only if we control the ships.

"4. The service afforded by foreign-owned vessels is second rate, hampers our exports and makes impossible proper increase of our overseas business. * * *

"Finally, in shipping, as in any other business, the real profit depends upon the volume handled. There is no need for me to tell you that when the available cargo is doubled, the profit may be multiplied not twice but 4 or 5 and even 10 times, or a large deficit converted into a substantial profit. But American ships are infants in the game, and must be aided until they become strong.

"The subsidy, as stated in my telegram to the President, stands on the same footing as the tariff. It is a protection for a weak industry. It is justifiable only when the industry is young. We support a ship subsidy because it is necessary for the growth of the business. When that need is past we are opposed to it.

"The subsidy to be effective must do two things: (1)

It must meet the difference in operating costs; (2) it must aid in building up a large volume of traffic. * * *

THE VALUE OF SHIP SUBSIDY TO THE FARMER

"What is the interest of the farmer in this? He sells his grain at the local elevator, his live stock at the nearest primary market, and cotton to the local factor, and his fruit to a jobber or broker. What interest, I say, has he in a merchant marine? The farmer had a vital interest in securing the best possible market

price for his products. It has been said so many times that I hardly need to repeat it here that the price of grain is made at Liverpool. It follows that he is interested in the delivery wagon which takes his grain to Great Britain. For a number of years cotton exports have represented practically the entire surplus of American exports over imports. During the season 1921 there were exported from the United States and Canada (and most of the Canadian exports come from America) 2,445,501 barrels and 2,722,327 bushels of apples. Is not the apple farmer decidedly interested in the availability of service which will make it possible for him to dispose of his surplus profitably, and while our exports of live stock are negligible, still our exports of meat and live-stock products are one of the most important in the whole list of American exports. The interest of the farmers is very great in these delivery wagons. The farmer in 1921 exported more than \$1,976,000,000 of raw agricultural products; of finished and unfinished agricultural products there were \$867,000,000. In addition, the farmer is vitally interested in the welfare of his customers in this country, manufacturers, laborers, merchants, etc.

"I want to stress the advantage it is to the American manufacturer and labor, which indirectly is a very great benefit to the farmer.

"The farmer has a still more direct interest than this. He has organized his own grain-selling agency, his own cotton-

"It is an old statement that 'Trade follows the flag.' If we would have an increasing export trade we must create a condition, through legislation, which will give the American shipowner such encouragement and such feeling of confidence and stability in his business, that he can develop all the facilities surrounding the successful operation of our shipping to a point where he can offer to our shippers all the advantages which they might secure through other channels."—F. R. Todd, vice-president John Deere Company.

marketing organization, his own fruit-marketing organization. It is not only well within the bounds of possibility but it is very probable that these organizations whose primary object is scientific and orderly marketing will decide to arrange to handle these exports themselves. In such case the American farmer becomes the American shipowner, not because he is primarily interested in shipping but because of the necessity of disposing of his own products.

"We recognize the difficulty of converting this subsidy into units of agricultural products. However, if a 5,000 gross ton ship is loaded full of wheat destined to Europe, it has about 367,000 cubic feet of available cargo space. Wheat in bulk occupies 47 cubic feet per ton of 2,240 pounds. Dividing 367,000 by 47 we have 7,808 tons.

"Multiplying by 2,240 pounds per ton we have 17,489,920 pounds, or, at 60 pounds per bushel, we get 291,498 bushels. The subsidy for 3,000 miles, New York to Liverpool, is \$750. Dividing the \$750 by the amount of grain, the subsidy amounts to about one-quarter of a cent per bushel.

"Upon the same basis of 367,000 cubic feet of cargo space and 130 cubic feet per ton for cotton we can load 2,823 long tons of cotton in a 5,000-ton ship. This means 6,323,520 pounds, or, at 500 pounds per bale, 12,647 bales. Using \$750 once more as the direct subsidy we find this means 5.93 cents per bale. From a southern port the distance would be a little greater, making the subsidy perhaps a cent per bale more. From Galveston it would be for 5,000 miles nearly 10 cents per bale.

"Obviously such a cost is entirely out of proportion to the benefits secured in a constant service available for the disposition of the surplus products. The amount of the subsidy to the boat is a little more than the marine insurance on grain and less than one-fourth of the insurance on cotton.

"I know that marine insurance varies with so many conditions as to make comparison difficult. But the rate quoted from Galveston to Liverpool on cotton in good steel steamers last Saturday was 19/16 percent of the value. With cotton selling at 18 cents per pound a bale is worth \$90. Insurance then would be \$1.408 per bale while subsidy would be 10 cents.

"Grain insurance runs 27½ cents per \$100 value during summer months, and 37½ cents during winter months. At present prices at the seaboard this means 37½ cents insurance on 67 bushels or about 5½ mills per bushel in the winter and 4 mills in the summer. The subsidy, however, will be only about 2½ mills per bushel.

"Let us remember that marine insurance is a guaranty against loss from storm. The subsidy will be a guaranty against loss from failure to reach market regularly and when markets are best. Marketing is today the farmer's chief problem. The ship subsidy is our best insurance for orderly marketing of the farmer's exportable surplus."

QUALITY OF THE OPPOSITION

In order that our readers may form their own opinion of the kind of testimony that was furnished by the three or four men who appeared in opposition to the Shipping Bill, we will now quote a few extracts from the *Record*. The first will be from the testimony of Benjamin C. Marsh, representing another organization of farmers.

"Mr. EDMONDS. I understood before I came here this

morning, Mr. Chairman, that the gentleman had made a remark about the President lending his help to an insidious campaign to rob the people of the United States. I would like for him to enlarge a little on that.

"Mr. MARSH. I didn't quite get your statement.

"Mr. EDMONDS. I understand you made the statement this morning before I came here that the President was lending his help to an insidious campaign to rob the people of the United States.

"Mr. MARSH. Yes.

"Mr. EDMONDS. Produce the proofs.

"Mr. MARSH. Produce the proofs? Hasn't the President urged the ship subsidy?

"Mr. EDMONDS. That is no proof.

"Mr. MARSH. Now, I answered your question, will you answer mine?

"Mr. EDMONDS. You answered with no proof.

"Mr. MARSH. Well, I deny that; I say it is.

"Mr. EDMONDS. You may deny it. That is your thought. You have no right to make charges that you can not prove.

"Mr. MARSH. I am responsible to the folks that sent me here, not to any agent—not to any Philadelphia Congressman. I make that statement.

"Mr. EDMONDS. You don't have to be responsible to me. I don't care who you are responsible to.

"Mr. CHINDBLOM. Let me ask, Mr. Chairman, does the gentleman state that he had the privilege of coming here and making any remark that he pleases to make and not be responsible for it and not subject himself to cross-examination?

"Mr. MARSH. I am willing to be cross-examined.

"Mr. CHINDBLOM. You are not showing that attitude now, sir.

"Mr. MARSH. I welcome it. Didn't the President indorse the subsidy bill?

"Mr. CHINDBLOM. Yes.

"Mr. MARSH. And I denounce the subsidy bill as an

insidious steal. If the President indorses the ship subsidy bill, I repeat that the President is indorsing an insidious steal to put over on the American people, and I am going to go all over the country saying that.

"Mr. CHINDBLOM. Oh, well, that won't make much difference, you know.

"Mr. MARSH. Well, now, it may.

"Mr. CHINDBLOM. But for a man to come here, Mr. Chairman, and deliberately offer an insult to the President of the United States and then say that he is not here for the purpose of answering questions put to him by a Philadelphia Congressman, I say is an outrage. * * *

"Mr. EDMONDS. Of course, the gentleman airs a lot of views here, and he probably has his own opinion. So far as I am concerned, it doesn't affect me so very much because I know the gentleman's views and have known them for a number of years.

"Mr. MARSH. That is why I am so complimented that you are asking me questions.

"Mr. EDMONDS. But you come here and because you happen to have a difference of opinion with the President of the United States, you have chosen to insult him before the committee. That is what I contend that you have done. The President has just as much right to his opinion on subsidies as you have, and if you have got any charges

"Several times in the past four or five years we have had shipments for South American ports bound on foreign vessels so split up as to make the first part of the cargo useless on arrival because parts of our machines would be left to come on a second boat and as our goods are threshing machinery we were too late for the season. While we can not, of course, prove that this was done by design and intentions to embarrass the sale of our goods, we feel perfectly sure of the fact and have yet to learn of this happening to our English competitors."
Findley D. Mount, president Advance Rumeley Company.

to make that he is trying to rob the American people you ought to be able to prove them and you have not been able to prove them. I have not heard a particle of proof here in two hours.

"Now, you have made other charges here, you charged that Mr. Howard, the man who leads the real farm union in the United States—you have charged that Mr. Howard was in receipt of \$100,000 a year from somebody or other, and that he was subsidized by other people and subsidized by a whole lot of people. Now bring your proof of that.

"MR. MARSH. Sure. * * * *

"MR. MARSH. Now let me correct a further statement. I said the Farm Bureau Federation gets money from the packers. That has been published widely and the fact proven in the farm press, and I say, if they didn't get money from the railway interests for selling the farmers out to the railroad interests in indorsing the Esch-Cummins law, they were miserably poor business men, and they are pretty clever business fellows.

"MR. CHINDBLOM. And of course that proves it, that they got the money, doesn't it?

"MR. MARSH. How is that?

"MR. CHINDBLOM. Your argument that, if they didn't get the money, then something else existed—that proves that they got the money?

"MR. MARSH. No.

"MR. CHINDBLOM. Then why say it?

"MR. MARSH. We are quite justified in making deductions. Do you mean to tell me that they would deliberately in cold blood massacre the farmers the way they did?

"MR. CHINDBLOM. Well, you are just throwing out suspicions and insinuations that everybody from the President of the United States down is corrupt because they disagree with you."

SHIPPING BOARD HONEYCOMBED WITH FOREIGN REPRESENTATIVES

"MR. EDMONDS. I don't want to ask Mr. Lasker. You say the Shipping Board is honeycombed with representatives of foreign governments; now say who they are. Mention their names.

"MR. MARSH. I won't mention any names.

"MR. EDMONDS. I want to get them just as much as you do.

"MR. MARSH. Ask Mr. Lasker and you will find out.

"MR. EDMONDS. I don't care to ask Mr. Lasker; I am asking you. You made the charge.

"MR. MARSH. I will make the charge and let Mr. Lasker disprove it if he can. If you want to know, ask Mr. Lasker; he won't tell me.

"MR. EDMONDS. You mean to tell me that you don't know any representatives of foreign governments in the Shipping Board?

"MR. MARSH. I don't want to go into details. I will be glad to try to get the information from Mr. Lasker. I will write and tell him the question.

"MR. EDMONDS. You deny then that you know who they are. You simply made the charge without any proof at all.

"MR. MARSH. If you want to put that interpretation on it, but if you want to know write Mr. Lasker and find out.

"MR. EDMONDS. If you know any, why don't you say so now. You have got the opportunity.

"MR. MARSH. I have not, but I am going to have a little later.

"MR. EDMONDS. I don't care anything about what you do later.

"MR. MARSH. I do.

"MR. EDMONDS. You simply make the charge here that the Shipping Board is honeycombed with the representatives of foreign governments. You have sent this out to your 600,000 members, yet you decline before a committee of

Congress to say who these people are, and I want to know just as much as you do.

"MR. MARSH. I will let you know when I get ready.

"MR. EDMONDS. You are not going to let me know now because you don't know yourself. That is the reason, otherwise you would answer me.

"MR. MARSH. We have had set-tos before, Mr. Edmonds. You sneakingly tried to impugn my record during the war before the House Committee on Merchant Marine and Fisheries.

"MR. EDMONDS. I didn't ever need to impugn your record; everybody knows your record. Do you want it to go in here? I will put it in again if you want to."

STATEMENT OF MR. ANDREW FURUSETH

The statement of Mr. Furuseth, although in opposition to the Shipping Bill, was in reality an able defense of the Seaman's Act. Mr. Furuseth, who is reputed to have framed this Act, is president of the International Seamen's Union of America. He represents the unlicensed personnel which, according to his own testimony, contains only 18 percent of native-born Americans.

Mr. Furuseth's contention is that there is no real differential in operating expenses due to the wages of the crew on an American ship. But, note this quotation from his testimony: "Now, that there is a differential in other directions, I do not deny; and I said in my examination in chief that if, for other reasons, you want a subsidy or you think a subsidy is necessary, that is for you to judge: but please do not make a pack horse out of the crew to carry the responsibility for those injuries."

MARINE ENGINEERS ENDORSE BILL

The statement of William S. Brown, president of the National Marine Engineers' Beneficial Association, may be summed up in the following quotation:

"Wishing to take as little of the committee's time as possible, I will state in conclusion that it would seem that the proposed bill offers the probability, in the opinion of this association, of creating the adequate merchant marine so necessary to the Nation and, at the same time, will provide work for the marine engineers, thousands of whom are either unemployed at the present time or have been forced into other lines of endeavor; it will also provide work for men of the other branches of seafaring who are in a position similar to that of the engineers, and as a whole tend to alleviate the general unemployment situation, particularly affecting those trades involved in the building of ship construction, repairs, manufacture of supplies of various sorts, etc.

"With the passage of the measure this is probable, whereas if the measure does not pass it is absolutely certain that unemployment, especially in all branches of the marine field, will become more acute and the Nation as a whole will be in an even more difficult position than at present with regard to general prosperity and national defense."

NEPTUNE ASSOCIATION ENDORSES BILL

The Neptune Association of Licensed Masters and Mates of Ocean and Coastwise Steam Vessels, Incorporated, is in favor of the Shipping Bill. The Neptune Association is composed of approximately 7,000 licensed masters and deck officers.

"This association," said Mr. John F. Milliken, secretary-treasurer of the organization, "is in favor of the ship subsidy bill. Nearly all of the industries in the United States are protected by a tariff. We believe that it is vitally necessary for our country to have an adequate merchant marine, with legislative protection and Government assistance, to deliver the goods of our country in time of peace; to spread American doctrines and develop American business throughout the world, and to assist our Navy in time of war."

Prospects for American Shipbuilding*

Motorship Economy So Marked That Change to Diesel Machinery Will Rival Change from Sail to Steam

By J. L. Ackerson†

IN order to analyze the prospects for American shipbuilding it is necessary briefly to analyze in turn, first—world shipping, second—world shipbuilding, third—American shipping, and fourth—American shipbuilding.

It is possible to have a revival in world shipping and in world shipbuilding without any great increase either in American shipping or American shipbuilding.

World shipping depends upon international trade, which in turn is dependent upon the desire to exchange international products, the ability to finance this exchange of products, and the time necessary to insure the accomplishment of these two items.

The desire to exchange products, of course, exists. The necessity for this interchange of products also exists, not only on account of trade conditions, but also due to the fact that foreign countries are of necessity under the obligation of exporting goods in order to pay their respective debts.

Although the desire to exchange products exists, the ability to finance this exchange does not, at least for many of the European countries, exist. It is necessary that large credits be established in these countries to start their industries in the manufacture of exports.

Probably the only two countries that are in a position to finance this interchange of products are the United States and Great Britain. At the present moment, the financial interests of Great Britain appear willing to loan money for this purpose. In the United States, at the present moment there does not appear to be that same willingness. Just how long it will be before this will be brought about is uncertain; but probably the time necessary to crystallize public opinion, to effect the necessary loans, and following that to establish manufacturing on a post-war normal basis in the European countries, will be not less than three to five years.

Following this line of reasoning, it would appear to me that the world shipping will not return to what may be termed its normal proportions until this period of time, varying from three to five years, shall have elapsed.

WORLD SHIPBUILDING

From the time this revival begins, an increased demand for ships will manifest itself. Whether new ships will be built or not as a result of this demand will depend upon two things, first, the tonnage necessary to carry out the increasing international trade; second, the tonnage actually existing at the time.

In viewing this, it should be remembered that on the whole there is no greater tonnage of vessels available today than would have been available today had the World War not taken place. Also, many of the ships now included in the world tonnage are old and obsolete. There have been few replacements of the better types of ships. The war tonnage, as a whole, cannot be regarded as a suitable and adequate increment to the merchant marine.

During the past eight years, comparatively few passenger vessels or combined cargo and passenger vessels, or even high grade cargo liners, have been added to the world tonnage.

The international trade revival that will unquestionably take place in the next three to five years will create a demand for vessels suitable for special trades, and also for passenger and combination passenger and cargo vessels.

These vessels when built will undoubtedly be built in accordance with the advances in engineering that have taken place in the past few years. Notable among these advances is the Diesel engine.

It would appear that when the demand for additional tonnage does manifest itself, the new tonnage required will at least be equal to the annual pre-war construction, possibly even greater.

AMERICAN SHIPBUILDING

Although it can be shown with reasonable clearness that there will be a demand for additional world tonnage, it does not necessarily follow that there will be a demand for American tonnage.

American shipbuilding, of course, depends upon American shipping. An increase in American flag shipping depends upon, first, an increase in foreign trade shipping, second, upon the ability of American flag vessels to compete in this trade, and third, upon an increase in coastwise trade shipping. Relatively speaking, there have been, and probably will be, very few ships built in the United States for operation under foreign flags.

INCREASE IN FOREIGN TRADE

Although an increase in international shipping is certain, the question remains whether American operators can operate American flag vessels in competition in these trades with foreign flag vessels.

Several of the larger operating companies are now seriously making this experiment. Most of the ships that are being operated in carrying out this experiment are of special types, for example:

The United American Lines, one of the Harriman organizations, is operating the *Resolute* and the *Reliance* in the first class passenger service between the United States, United Kingdom and the Continent.

That line is also operating second and third class combination passenger and cargo vessels, the *Mount Carroll*, the *Mount Clinton*, and the *Mount Clay*, between the United States and the Continent.

The American-Hawaiian Steamship Company is operating large fast freight liners, the Diesel-engine ships *Californian* and *Missourian* between Pacific ports, Atlantic ports and European ports.

The United States Lines is operating first class passenger vessels between the United States and the United Kingdom.

It is yet too early to predict the results that can be obtained over any sustained period of time in these operations.

The success will probably depend, to a great extent, upon pending legislation. With favorable legislation it is probable that the results will be satisfactory, in which case there will undoubtedly be a decided demand for—

- A—Passenger vessels
- B—Combination liners
- C—Special cargo liners

all for operation in foreign trade under the American flag.

These vessels of necessity will be built in the United States.

*Address delivered before National Foreign Trade Council Convention, Philadelphia, Pa., May 11, 1922.

†Vice-president Merchant Shipbuilding Corporation, Chester, Pa.

The coastwise trade has heretofore furnished the greater part of the merchant work that has been performed in American yards. This trade is increasing. Much of the trade that heretofore has been carried by rail is now being carried by water.

A great part of this carriage is done by special types of ships, as, for example, the Luckenbach ships, American-Hawaiian ships, Red D ships, and Agwi ships.

Many of the ships in these and other lines active in the domestic trade are old and obsolete. Undoubtedly there will be replacements in the respective types in the next few years. Many replacements are actually now in contemplation.

Competition in these trades will bring about a demand for more economical operation. This will be accomplished probably by obtaining new and special types; and by the conversion of existing ships.

Already there is much activity on the part of ship operators looking toward the building of new ships and the conversion of some of the more suitable of the Shipping Board ships.

DIESEL SHIPS

Diesel ships deserve special consideration. Although there is no question regarding the exceptional economy to be obtained in the operation of these ships, American operators have been slow to adopt them.

The economy of operation is so startling that, in my opinion, the change from the present accepted type of machinery to Diesel machinery will make a change in shipping in the next decade which will be not unlike the change from sail to steam.

This change in the ships in future to be built will, in my opinion, extend not only to cargo vessels, but progressively will extend to passenger ships, first with the low powered twin screw passenger ships, and quite probably later to the larger powered ships.

The results, with which all are familiar, of the *William Penn*, which showed a saving of approximately \$53,000 in one trip around the world, will inspire a number of operators to demand the same economy.

There will be comparatively few Navy ships built in the next few years. Navy building will be confined to airplane carriers, cruisers, scouts and submarines.

CONCLUSIONS

Summing up, it seems to me that the following conclusions are clear:

First—It will take from three to five years to stabilize international finances and to insure the establishment abroad of credits necessary to enable foreign industries to place themselves in a position to export large volumes of goods.

Second—During this period international trade will greatly increase until at the end of, say five years, it will attain what may then be termed its "normal."

Third—That during this period there will be an increased demand for ships. That this demand will cause to be culled from the present stock of unemployed ships those that are most suitable, and will then cause the building of new ships of the most suitable type, representing the advances in shipbuilding during the past several years.

Fourth—That this increase in international trade will bring about the desire on the part of American operators to engage in this trade.

Fifth—That this desire on the part of American operators will, if suitable shipping legislation is enacted, cause them to place contracts in American yards for new and special types of ships for operation under the American flag. That this demand for shipbuilding will be augmented by the demand on the part of American operators for special ships to be used in the coastwise and domestic trade. A part of this demand will be met by the conversion of existing American tonnage where practicable, but a part of it, however, will of necessity be provided by new ships, to be placed in American yards. An increasingly greater proportion of these ships will be equipped with Diesel engines of an approved type.

Sixth—A small demand will exist for naval auxiliaries, as outlined above.

This, then, is how I view the prospects of American shipbuilding—fair, but not alluring.

Operating Problems of the American Shipowner*

Wage and Subsistence Costs—Manning Requirements—Changes Recommended in Our Navigation Laws—The Ship Subsidy Bill

By Eugene E. O'Donnell†

NEVER before in maritime history have operators had to wrestle with the problems of so great a suddenly created merchant marine. In other nations the growth of shipping has been gradual. Here in America our gross register tonnage went up from 8,871,000 in 1917 to 18,282,000 in 1921. All of the amount of this increase was in ships designed for international commerce. Not only has our tonnage thus rapidly multiplied, but American owners and operators have been compelled to face, in most cases with little experience, the exigencies of strange new trade with the ports of distant foreign countries.

Except for the vessels acquired before the war, which in many cases were carefully designed for the work in hand, it cannot be said that the merchant marine as a whole is especially adapted to its particular requirements. The new fleet consists to altogether too great a degree of steamers of comparatively low speed and of the "tramp" order. We are

lacking, of course, in swift passenger steamers, but we are lacking also in cargo steamers of the so-called liner type, which after all, if not the backbone of a merchant marine, is a class of ship of very great importance. This undeniably handicaps our owners and operators who contemplate the development of a cargo liner service, for vessels which have no reserve speed will necessarily find it difficult to maintain a regularity of service, especially in the trade like that of the winter months on the North Atlantic.

However, a considerable proportion of one-half of the steel tonnage of the Shipping Board which is characterized as good tonnage contains many ships fit for what may be described as the berth service to distant foreign ports, like the 7,800-deadweight-ton Hog Island ships, the 8,800-ton freighters and the larger shelter-deck and other steamers whose capacity in a few cases runs up to a maximum of 12,000 tons. Here is a fleet not to be despised in any survey of the world's shipping, and until we secure better steamers, these, outside of the "tramp" or bulk cargo service, must be regarded, together with the pre-war ships of the older com-

*Abstract of paper read at spring meeting of Society of Naval Architects and Marine Engineers, New York, May 19, 1922.

†Manager, Marine Department, C. H. Sprague & Son, Boston, Mass.

panies, as the main, active, operating backbone of our merchant marine.

HANDICAP OF WAGE AND SUBSISTENCE COSTS

First of the problems of American ship operators in this connection is the hard, undeniable fact that they have to pay more money for the wages and subsistence of their crews than do their European or Japanese competitors. American shipboard wages have historically been from 30 to 40 percent above British shipboard wages, and it is estimated at the present time that British wages are about 15 percent above Scandinavian. This is a handicap which in my judgment, and I believe in the judgment of virtually all practical owners and operators, can be overcome only by national assistance.

A great deal is being carelessly said about the higher "efficiency" and "economy" of American officers and men. It is not to be denied that many years ago, in the heyday of our wooden-built merchant marine, there was a higher efficiency in American ocean ships than elsewhere, generally speaking. But it must not be forgotten that this was an efficiency that had gradually been attained through many years of effort and experience.

It would be idle to pretend that any such relative efficiency has been attained in the brief period of the years between 1915 and 1922. Though we have in our ships many of the best officers in the world, our officers as a whole and on the average fall short of the experience of their European competitors. This is even more signally true of our crews. This is a handicap, however, which time itself will cure; in fact, any disparity on this point between Europeans and ourselves is even now rapidly lessening. I am one of those who believe that, given a fair chance, American officers and crews will gradually reestablish the supremacy which in the last century was theirs as the most capable men of their calling in the world.

AMERICAN AND BRITISH WAGE DIFFERENCE

The wage difference between American and British ships is somewhat less now than it has been of recent years, and must be regarded as temporary due to the abnormal condition of world shipping, but it is still a wide difference, as will be demonstrated by the following comparison of the costs of wages and subsistence of an American and a British cargo steamer of 3,500 gross tons, and the wages and subsistence of an American and a British cargo steamer of 6,000 gross tons:

WAGE COMPARISON—AMERICAN AND BRITISH OIL-BURNING STEAMERS, 3,500 GROSS TONS APRIL 12, 1922

	A. S. O. A. scale	British scale
Master	\$265.00	£42 10 0
First officer	135.00	20 10 0
Second officer	130.00	16 0 0
Third officer	115.00	13 0 0
Able seamen (6)	285.00	51 0 0
Chief engineer	240.00	26 10 0
First assistant	155.00	19 10 0
Second assistant	130.00	16 0 0
Third assistant	115.00	13 0 0
Oilers (3)	165.00	33 0 0
Firemen (3)	150.00	31 0 0
Steward and Cook	105.00	14 0 0
Second cook and baker	70.00	10 0 0
Messboys (3)	90.00	25 10 0
Radio	90.00	13 10 0
Wiper	55.00	.....
	\$2,315.00	£345 0 0 (\$1,507.65)
A. S. O. A. scale		\$2,315.00
British scale, present exchange, \$4.37 = £1		1,507.65
Subsistence difference		\$807.35 180.00
Total monthly difference		\$987.35
Annual difference for 11 months at present rate of exchange		\$10,860.85

COMPARISON OF AMERICAN AND BRITISH PAY-ROLLS—NEW SCALE. 1922 APRIL 12, 1922

Comparison of wages of a steamer of 6,000 gross tons, 3 boilers, coal burning, suitable for general ocean tramping, under the British scale, United States Shipping Board scale, and the American Steamship Owners' Association scale.

	United States		United Kingdom
	S. B.	A. S. O. A.	
Master	\$270.00	\$275.00	45/—
Mate	165.00	165.00	20/10
Second mate	145.00	140.00	16/—
Third mate	130.00	125.00	13/—
Carpenter	65.00	70.00	12/10
Boatswain .....	.....	.....	11/10
Able seamen (6)	330.00	285.00	60/—
Ordinary seamen (2)	80.00	70.00	11/—
Chief engineer	240.00	250.00	24/10
Second engineer	165.00	165.00	20/10
Third engineer	145.00	140.00	16/—
Fourth engineer	130.00	125.00	13/—
Deck engineer	70.00	70.00	11/10
Oilers (3)	195.00	165.00	33/—
Firemen (9)	517.50	450.00	94/10
Coal-passers (3)	150.00	120.00	30/—
Steward	105.00	105.00	14/10
Cook	90.00	90.00	13/10
Second cook	70.00	70.00	9/10
Messboys (3)	105.00	90.00	8/10
Radio	90.00	90.00	13/10
	\$3,257.50	\$3,060.00	492/—
Pounds sterling converted at \$4.37			\$2,150.04

	British scale of May, 1, 1922	
	On S. B. scale	On owners' scale
United States	\$3,257.50	\$3,060.00
United Kingdom	2,150.04	2,150.04
Difference	\$1,107.46	\$909.96
Subsistence difference	240.00	240.00
Total monthly differential	\$1,347.46	\$1,149.96
Annual differential at 11 months	\$14,822.06	\$12,649.56

In the above comparison a similar number of crew in each vessel has been used, but it is a generally accepted fact that American vessels carry a greater number in the crew than do foreign vessels. This difference is more especially to be found in the "tramp," coastal or short-voyage American steamers as compared with the foreign vessels; while in the case of the passenger liners or cargo liners the British manning scale more nearly approximates our own. On the other hand, the manning scale of Continental European ships will generally be found to be less than the British.

MANNING REQUIREMENTS OF AMERICAN AND BRITISH SHIPS

The manning requirements contained in the United States statutes as compared to the requirements contained in the British Merchant Shipping Act are illustrated.

Section 4463, United States Revised Statutes, provides that no vessel of the United States subject to United States laws shall be navigated unless she shall have in her service and on board such complement of licensed officers and crew, including certificated life boat men, as in the judgment of the local inspectors may be necessary for her safe navigation. An entry shall be made in the certificate of inspection covering the number of officers and men required.

A minimum manning scale for the officers is further contained in this section of the law which requires that every ocean or coastwise seagoing merchant vessel of the United States propelled by machinery and every ocean-going passenger vessel shall have a minimum number of licensed officers for the vessel's safe navigation according to the following scale:

"All such vessels shall have a licensed master.

"All vessels of 1,000 gross tons or over navigating on routes of more than 400 miles shall have three licensed mates.

"If the vessel is between 200 and less than 1,000 gross tons, two licensed mates are required.

"If the vessel is between 100 gross tons and less than 200 gross tons, one licensed mate; but if the time required to make the voyage from port to port exceeds 24 hours, two licensed mates shall be required."

There is a specific requirement in this section that the officers shall be divided into three watches, and under this

system the local inspectors require the same number of engineers as licensed deck officers.

The British Merchant Shipping Act is silent as to the number of unlicensed personnel required on board of a British ship, except in the case of emigrant ships, which may be considered as passenger liners in the transatlantic trade or the liners to India, Australia or South Africa. The crewing of these vessels will be dealt with later in this paper. As to the licensed officers, I wish to direct your attention to the fact that the requirements are not positive or mandatory in the full sense and state as follows:

"1. Every British foreign-going ship and every British home trade passenger ship, when going to sea from any place in the United Kingdom, and every foreign steamship carrying passengers between places in the United Kingdom, shall be provided with officers duly certificated under this Act according to the following scale:

"(a) In any case with a duly certificated master:

"(b) If a ship is of 100 tons burden or upwards, with at least one officer besides the master holding a certificate not lower than that of only mate in the case of a foreign-going ship, or of mate in the case of a home-trade passenger ship.

"(c) If the ship is a foreign-going ship, and carries more than one mate, with at least the first and second mate duly certificated.

"(d) If the ship is a foreign-going steamship of 100 nominal horsepower or upwards, with at least two engineers, one of whom shall be a first-class and the other a first-class or second-class engineer duly certificated.

"(e) If the ship is a foreign-going steamship of less than 100 nominal horsepower or a seagoing home-trade passenger steamship, with at least one engineer who is a first-class or second-class engineer duly certificated."

While it is acknowledged that most British ocean ships in the foreign trade carry as many licensed deck officers as American ships and frequently as many engineers, the character of the British legislation is such that they may reduce the number at any time and are not subject to the penalties for failure to carry the full quota, as happens in the case of American ships by virtue of the penalty clause contained in Section 4463.

With further reference to the unlicensed personnel on American ships, in addition to the authority reposed in the local inspectors which is contained in Section 4463, Section 2 of the Seaman's Act provides that the sailors while at sea shall be divided into at least two watches and the firemen, oilers and watertenders into at least three watches. The seamen may not be shipped for duty alternately in the fire-room and on deck, and the firemen may not be shipped to perform duty in the fireroom and on deck; while in the American ship on Sundays and holidays the crew shall not be permitted to perform unnecessary duties nor shall they be required to do duty on any week day of more than nine hours while the vessel is in a safe harbor. In this regard, let me again point out that the British law is silent.

Section 13 of the Seamen's Act requires that 65 percent of the deck crew shall be able-bodied seamen and to obtain a full-fledged A. B. seaman's certificate a man must have at least three years' experience on the deck of a vessel at sea.

Section 14 of the Seamen's Act relates to the life-saving equipment and the manning of boats and rafts with a definite

number of licensed officers, able seamen and certificated lifeboat men. All boats and rafts carrying more than fifteen persons are required to be in charge of a licensed officer or able seaman. The British Merchant Shipping Act is silent on the question of watches at sea and as to the requirement of the number of able seamen. Only in the case of emigrant or passenger ships does it carry a schedule as to crew requirements.

Again I desire to direct your attention to the moderate terms of the language employed.

"1. Every emigrant ship shall be manned with an efficient crew for her intended voyage, to the satisfaction of the emigration officer from whom a certificate for clearance of such ship is demanded; after the crew have been passed by the emigration officer, the strength of the crew shall not be diminished nor any of the men changed without the consent in writing either of that emigration officer or of the superintendent at the port of clearance.

"2. Where the consent of a superintendent has been obtained, it shall, within twenty-four hours thereafter, be lodged with the said emigration officer."

The Board of Trade regulations, however, contain certain provisions with regard to the manning of lifeboats and rafts. These regulations are not as stringent as the requirements of Section 14 of the Seaman's Act. In the case of a British ship a certificated lifeboat man may take charge of a boat or raft, and this permits stewards and other petty officers to take charge and thereby lessens the requirements as to the number of able seamen.

If American ships were everywhere in the majority in overseas trades, the wage difference might not be so heavy a handicap as it is at present. It is the foreign ships that are far more numerous, and their managers and operators are entrenched in position as ours are not. In order to develop our own merchant marine, we must take a part of their present trade away from our enterprising foreign competitors. I need not point out that it is difficult to do this with ships confined to a relatively few types, maintained at substantially higher costs for wages and subsistence.

NATIONAL ASSISTANCE ABSOLUTELY NECESSARY

There is only one way in which the result which we all seek can be accomplished, and that is by national assistance such as has been recommended to Congress by the American Steamship Owners' Association and the United States Ship Operators' Association in the representations which they have recently made to the Congress of the United States.

It is a matter of regret that our inspection requirements do not make it obligatory that licensed engineers have an adequate shop training. It is more and more manifest that this is needed to reduce repair bills and maintain engine and boiler efficiency.

As to the firemen in coal-burning steamers, we have a present good supply, but relatively few of them are American citizens. The present shipping subsidy bill will certainly contain a stiff requirement of citizenship for the unlicensed members of the crew, at least in the deck and engine departments, and it is a question how such a requirement can be met in coal-burning firerooms. On oil-burning steamers a

"Uncle Sam is not a Santa Claus. He is giving us no gift, no bonus, in this shipping legislation. All he does is to try to assure for us a fair, even chance in competition. A fair chance is something which we have not had for sixty or for seventy years. If this bill passes, we will have it, and then it will be up to us to make such use of it as was made by the shipowners, operators and builders of the brilliant half century before the Civil War. They were given a chance. They took it, and they made such glorious use of it that the maritime world has not yet forgotten the years when American ships embodied the highest efficiency and success the world had ever seen. What we will have to do now is to prove ourselves as good men as our predecessors in this industry."—Eugene E. O'Donnell.

large force of citizen firemen, most of them young men, is developing.

One of our greatest present deficiencies is in masters of the requisite business training and experience for the overseas trade. Many excellent captains, good navigators, seamen and executives, have passed most of their careers in the coastwise or near-by trade and are having their first experiences with the purely business problems that present themselves in the distant ports of foreign commerce. It is desirable also that the chief mates of our foreign-going steamers, some of whom will soon succeed to command, should acquire as soon as possible a knowledge of business as it is conducted overseas.

I am of the opinion that a shipping subsidy law should not require an American percentage of more than forty, to begin with, in the deck and engine departments. It might follow in this respect the graduated increase in the proportion of able seamen as provided for in the La Follette seamen's law. To develop what is apparently expected by Congress and the country in the form of an unlicensed seagoing personnel, the greater part American, will require close study and patient effort on the part of owners and operators of steamers in the merchant marine, and could best be obtained through a system of naval reserve training.

In the La Follette seamen's law are presented not a few difficult problems. This act was passed with the assumption that it would provide freedom—so-called—for seamen. The practical result, however, has been the lessening of discipline on American ships as reported by ships' officers and United States consular agents.

Our steamboat inspection laws and rules and other navigation laws and regulations were made the object of a very careful study more than two years ago by a committee of maritime men established by authority of the Shipping Board—a committee of which Mr. P. A. S. Franklin was the chairman. Mr. Alfred Gilbert Smith was chairman of the sub-committee on construction and inspection, and Mr. J. Parker Kirlin was chairman of the sub-committee on personnel and legal adviser to the committee.

As is known to most of us, that committee completed its deliberations and presented its report to the Shipping Board two years ago, and the legal division of the Shipping Board is now engaged in recodifying and consolidating the navigation laws in accordance with the committee's report. I can do no better by way of indicating what ought to be done to cure the unjust or obsolete features of our maritime laws and rules than by summarizing the recommendations of this committee as this report was recently released to the press by the United States Shipping Board.

SUMMARY OF REPORT OF NAVIGATION LAWS COMMITTEE

It was found that our navigation laws are scattered through a large number of volumes of statutes and regulations passed at different times, and in many cases amendments have been enacted with clauses repealing acts and parts of acts inconsistent therewith, making a comparative study of the various statutes and regulations necessary in order to determine just what the law or regulation is on any particular subject. It

was found also that authority to make regulations which were to have the force of law and the responsibility for enforcing the laws were scattered among a number of boards and bureaus in different departments of the Government. The committee considered that next in importance to the recodification of the law was the consolidation of responsibility for enforcement in a single department.

Steamboat Inspection Laws.—The committee found that much of the criticism directed at the Steamboat Inspection Service was due to the mandatory character of the laws under which this service operates and the fact that no discretion is left to the officers responsible for the enforcement of the law.

An example is that of the annual hydrostatic test of marine boilers, using cold water, of one and one-half times the working steam pressure allowed.

Practical engineers claim that it is unwise annually to subject marine boilers to a stress the result of which makes doubtful the value of the application of this hydrostatic pressure at such frequent intervals.

A further requirement of the inspection laws is the annual inspection of the hulls of cargo vessels. At these inspections it is required that all cargo be discharged and the boilers emptied in order that the inspection may be made. This means a loss of from twenty-four hours to two or three days, depending upon the size of the vessel.

It is suggested that passenger vessels might very well be subjected to these

annual inspections, with the exception of the hydrostatic boiler test, and that the life-saving equipment of all vessels should be annually inspected. The inspection of the hulls of cargo vessels might properly be made at the survey periods, once in three or four years.

It is particularly desirable also that American vessels trading between ports in foreign countries should not be obliged to return to an American port for the periodical inspections required by law and regulations made pursuant thereto. These inspections might well be carried out by representatives of the American Bureau of Shipping located in various foreign ports.

Seamen's Act.—It is the general belief that the repeal of the Seamen's Act will place American shipping on an equality with foreign vessels. This is not the fact, however. What the Seamen's Act really does is to place added burdens upon the American ship which are not applied to foreign vessels, and, while it should be materially modified, there are certain humane features which should remain undisturbed. Those features, which have met with the greatest opposition from shipowners and which have caused the greatest hardships are the language tests, able seamen requirements, the excessive requirement of lifeboat men and the frequent payment of wages to seamen in foreign ports.

Section 14 of the Act, which relates to life-saving equipment, was taken from the regulations of the International Conference on Safety of Life at Sea. These regulations were intended primarily to apply to passenger vessels engaged in trans-oceanic trade. The application of these stringent requirements to our small coastwise and inland vessels has reduced their passenger allowances, ultimately forcing several of these companies to suspend operation.

"So long as any usable part of the government-owned fleet remains in the possession of the Government it will act as a damp blanket on the hopes and plans of American shipowners and operators and also American shipbuilders. There is good reason to believe that, if the now proposed Shipping Bill is enacted, a very large proportion of the good Shipping Board tonnage can be disposed of within two years. American owners and operators very earnestly desire the continuous withdrawal of the Government from vessel ownership and operation until the government-owned fleet is entirely disposed of by sale or scrapping at the earliest practicable date. This is a first essential of the firm development of our merchant marine."—Eugene E. O'Donnell.

It has been earnestly recommended by the Shipping Board Committee that Section 13 of the Seamen's Act be so amended that the extreme requirement of three years' apprenticeship for a rating as able seaman be reduced to a reasonable period so that this manifest discrimination against young Americans may be eliminated.

Continuous Discharge Book.—Another important recommendation of the committee affecting the seamen's law and the sea going personnel was one in favor of the introduction into the American service of the Continuous Discharge Book, with its record of the conduct and efficiency of seamen. It has long been in use in the British and other foreign services. This book has already been given out by the Pacific American Steamship Association with marked success and will be utilized also by the American Steamship Owners' Association.

Until the government-owned fleet can be disposed of there can be no objection to the maintenance by the Shipping Board of essential ocean services non-competitive with private enterprise. But this situation must be handled very carefully so that private plans may not be blocked. Every effort ought to be made by the Shipping Board to turn every one of the essential services over to private ownership and management at the earliest possible moment. Many operators dread more than foreign competition even the faintest risk of the competition of their government.

PROMPT PASSAGE OF SHIPPING BILL DEMANDED

Let me emphasize the truth which all practical men of our industry realize, that the government-owned fleet can never be sold until ample national aid is provided for the operation of those ships after they have passed into the hands of those who have the knowledge and the means to use them. Absolutely vital to the success of the American shipowning and operating industry is the prompt passage of the great Shipping Bill proposed by President Harding. If that fails, everything is lost that has been done toward a permanent restoration of American shipping in the overseas trade. If that fails, the American people lose all hope of realizing anything on their \$3,000,000,000 investment in the shipping business. The national importance of this measure cannot be overestimated. Our foreign competitors are anxiously watching the result of the present legislative effort in Washington. They know as well as we know that this bill, once enacted, will make America a great commercial power on the seas. They dread the result of national aid applied to shipping exactly as it has been so successfully applied in the past to manufacturing, mining, farming and other protected industries in America.

WHAT THE SHIPPING BILL WILL DO

The pending shipping measure offers substantial aid to every branch of our merchant marine. It proposes that 50 percent of the immigration into this country be reserved to American ships. This of itself will be a most powerful help to the regular mail, passenger and cargo lines of transatlantic steamers. Another feature of the bill is the deduction from income taxes of shippers of 5 percent of the freight money

on goods exported or imported in American vessels. Though this will not directly benefit the shipowners, it will offer a strong inducement to shippers inward and outward to prefer the American flag and will thus assist to give American ships the full cargoes so necessary to profitable operation. Exemption of net earnings of American ships in the foreign trade from Federal taxation, if the amount of the exemption is pledged to the building or purchase of new ships, will encourage shipbuilding and increase the active merchant marine. The construction loan fund of \$125,000,000, while costing the Government nothing in the long run, will promote the building of new tonnage of superior character.

Very important is the provision in the new bill that will

make it possible to secure more liberal allowance for depreciation for shipping, thus placing us more nearly on an equality in capital costs with our competitors. President Harding's policy of prompt diversion of the army and navy transport services to the merchant marine is made possible in the new legislation. An extension of the coastwise law to the Philippines is certain to have the same beneficial effect on shipping and trade as the extension of the coastwise law to Porto Rico and Hawaii.

What shipowners and operators are probably thinking most of, because they can measure its advantage

in dollars and cents, is the direct aid of the new bill in the form of compensation or encouragement to both cargo ships and mail ships. This is the feature of the new proposal that is most actively discussed. It is the part of the bill that must meet the sharpest opposition. But let nobody imagine that this direct compensation was put into the bill to be pulled out again. Without the direct aid of the proposed compensations or subsidies, the great effort of the nation to solve its shipping problem cannot and will not succeed. The indirect aids are themselves inadequate. If the nation is going to help its shipping it must help it effectively and not place it half-way on an equality with its overseas antagonists. Nothing less than complete action will suffice.

We recognize frankly that, though we need all this entire measure of government help and can do nothing of ourselves without it, nevertheless we cannot lean on government aid alone. Given all these improved conditions, the problem of the American merchant marine must, after all, be actually worked out by American shipowners, operators and builders through their own exertions. We must win our own success, achieve our own destiny. We must be quick to distinguish and adopt the newest and best ideas of ship design and construction. We must operate our ships with the utmost possible enterprise and economy.

FLEET CORPORATION SALARIES TO BE REDUCED.—The House of Representatives has finally prevailed that the appropriation bill providing funds for the Shipping Board for the fiscal year ending June 30, 1923, shall provide for a reduction of the salaries paid to vice-presidents of the Fleet Corporation. The Senate conferees on May 9 finally agreed to a compromise which allows 6 salaries at not to exceed \$25,000 each, and 2 at not to exceed \$20,000 each.

"Either this present bill must be promptly enacted, or the United States in defiance of sound business, and in defiance also of the instinct and conviction of the vast majority of its own citizens, will be committed to a policy of government ownership and operation in the shipping business, and worse than that, to a policy of governmental subsidized competition with American private capital and enterprise. Such an unjust policy as this would not be tolerated for a moment by manufacturers. It would not be tolerated by agriculture. It should not be imposed on the merchant marine."—H. H. Raymond, President American Steamship Owners' Association.

Developments In Marine Insurance

What Is "Ordinary Course of Transit"—Barge Canal Coverage—Syndicate and Salvage Operations

By "Bordereaux"

ONE of the eternal questions in the marine insurance market is what is the meaning of "ordinary course of transit" in the warehouse to warehouse clause. The assured finds it difficult to understand how there can be any break in an insurance that covers from the warehouse of the shipper to that of the consignee, even though goods are temporarily placed in warehouse en route. The question has assumed vital interest of late in view of the possible changes in the tariff which have caused some importers to stop their goods at a foreign point awaiting a definite settlement of the tariff controversy. Many importers of Egyptian cotton are, for this reason, ordering their cotton held in Liverpool, and that means storing the shipment and interrupting its transit.

It should be understood by the assured that the moment the transit is broken, not only does the insurance terminate but it does not automatically reattach when the goods are again put in transit; it is treated under marine policies as a new risk. However, if an assured's policy covered both from Egypt and Great Britain, the insurance from Liverpool would attach as a new shipment at the time of the cotton leaving the warehouse for destination.

Numerous phases of this question arise with regard to goods which arrive in the United States and are temporarily stored awaiting distribution. Thus many tea importers who bring teas via the Pacific Coast place them in storage in Coast warehouses for a short time before distributing them throughout the United States. Even though the policies of such importers cover to any point in the United States, the insurance is terminated by the warehousing of the teas and does not reattach on their subsequent reshipment. However, as above indicated, if there were a clause in the policy covering from one point in the United States to another the assured would be covered on reshipment. Many policies contain a specific clause in cases of this kind either covering while in warehouses en route or else providing for the reattachment of the insurance on reshipment.

Still another prolific cause of misunderstanding along this same line arises in connection with goods being placed in bonded warehouses at this port. Many importers are apparently under the impression that, if held but temporarily in bonded warehouses, the policy continues in force, while others with specific insurance for their bonded goods expect the goods to be insured when finally taken from the bonded warehouse to the warehouse of the consignee.

Although the matter of storage and transit warehouses is confusing to the layman, yet the distinction is clear cut, customs and appraisers stores being included in transit sheds while general order, bonded warehouses and other stores used for storage purposes are not considered as transit warehouses. Goods are still in ordinary course of transit while in the former sheds.

Barge Canal Coverage

IT was doubtless gratifying to friends of the New York State Barge Canal to learn that on the official opening date no less than ten fleets awaited the word to sail, and fifteen more got away within a week after. Port Superintendent John S. Gaynor predicts a record season. In boosting the canal, Governor Miller calls attention to New

York's unselfish attitude in not charging tolls for the use of this waterway. Up to 1880, when the toll charges were abandoned, \$135,000,000 had been collected by New York State through the revenue from this source. Instead of charging for its use, New York has spent \$154,000,000, since 1903, in its improvement and enlargement.

Last season many complaints were heard about the failure of the shipping public to take advantage of the facilities offered by the canal for handling both through and local freight. Shippers claim that they dislike being compelled to shift during the winter months to the railroads, with the various changes thus made necessary in their methods of routing shipments, and the slight saving in freight, they insist, is not sufficient inducement to overcome the disadvantages of canal traffic. Many shippers state that the canal insurance charges offset the freight savings; but the underwriters who insure canal barges and cargoes claim that there is no ground for a reduction in rates, as last year did not show a profit, mainly due to numerous strandings in the narrow portions of the waterway.

Registered Mail Losses

THE recent registered mail bond robbery, by which the Chase National Bank is reported to have lost half a million dollars, again directs attention to the hazardous character of insuring bearer bonds. Within the past year far too many marine insurance offices have been hard hit by losses from this source, and several have altogether discontinued writing this kind of business. The rates are so small and the values involved are so large that one loss is likely to wipe out several years' premiums. It is quite possible, indeed, that one heavy loss would make recoupment out of the question. In the robbery above referred to there appears to be some doubt as to whether the transit underwriters' risk had attached, because the policies provide that the risk under the transit policy does not attach until the packages have been mailed. Prior to that time the risk is on the sender or his surety underwriters.

Cotton Flood Risks

MARINE underwriters are considerably disturbed by the recent frequency of damage to cotton by floods in the South. The Trinity River flood at Waxahachie, Texas, washed away more than one hundred bales and damaged eleven hundred more. Of this number it is estimated that fully four hundred bales were covered for flood risk by marine insurance. Under open cotton contracts the flood risk is regularly covered, the charge for such hazard being ten cents, and it is included in the basis rate. Cotton stored in warehouses at the port while under marine policies is subject to additional premium for the flood risk, if such warehouses are less than eleven feet above mean low water.

Lake Self-Dischargers

IT is frequently asked lake cargo insurers what difference in rates is likely to develop in view of the impressive improvements in lake cargo carriers and the facilities for handling shipments. There is, for example, a new type of vessel on the lakes that is known as a self-discharger which

is to be used in carrying ore and other heavy bulk cargoes. This craft will lessen the present time of discharge; and that is saying considerable in view of the fact that a vessel is already able to unload twelve thousand tons of ore and to load an equal amount of coal and sail from port on her return trip the same day she arrives. Oddly enough, the effect of these improvements on underwriting should be to increase the hull rates; the logic being that the less time taken in ports means the more time spent in navigation, with a consequent increase in hazards.

East Coast-West Coast Service

INTERESTING underwriting phases have come to the fore in connection with the first round-trip between New York and the West Coast recently scored by a steamer of the Pacific Mail line. This service can boast of several fine modern vessels especially attractive for passenger carriage and light shipments. The point that interests the underwriters is the numerous stops made, especially on the West Coast of Central America. These interruptions to the voyages are of more interest to passengers and shippers than to insurance men. Such bits of navigation, particularly on the part of large steamers, add considerably to the risk because of the increased hazards of collisions and strandings.

Competition in Repairs

THE well authenticated report is that no less than eight shipyards submitted bids on the steamer *Granite State*, and that the successful bidder got the job at a figure \$40,000 lower than its nearest competitor. The hull underwriter views this active competition in repair work with un-mixed satisfaction. To him it means a marked saving in both particular average and general average repair costs.

Pacific Coast Rates and Conditions

ON the Pacific Coast rates continue to be uniformly low in the marine insurance market. There has been little stimulus given to a stiffening of the tariff, but there are no results as yet to encourage the underwriters. Conditions are, however, looking up, in that they are slightly more stringent. It is becoming increasingly difficult there for brokers to cover merchandise written with "fancy" conditions. For example, it was recently found impossible to cover in the San Francisco market the risk of leakage of linseed oil in barrels. Eighteen months ago such an offer would not have gotten past the first office to which it was submitted. This indicates a slow but significant return to the normal basis. The theft and pilferage situation has greatly improved of late on the West Coast, although the underwriters are uncomfortably uncertain as to whether this is the result of a betterment of the public moral fiber, or merely because goods simply can not be sold, even by the thieves themselves.

Marine Syndicate Conditions

IN an official summary of its recent annual reports the management of the American Marine Insurance Syndicates makes the statement that from organization, August 10, 1920, to December 15, 1921, Syndicate "B" received total earned premiums in the sum of \$679,588.35, and received interest amounting to \$8,881.02. Its total payments for losses, commissions and net expenses amounted to \$211,402.63. The credit balance, therefore, was \$477,066.74 for that period. Syndicate "C" wrote premiums of \$8,372,388.96, of which the total of earned premium is \$4,207,741.47. To this should be added interest amounting to \$32,989.99. The total of payments for losses, commissions, net expenses, premium tax and expense reserve was \$2,989,134.11; making

the credit balance \$1,251,597.35. There has been practically no activity in Syndicate "B" for almost a year, due to the inability of the Shipping Board to sell its vessels.

It is important to note that the Syndicates' management has met the repeated request of the Shipping Board for relief in the schedule rates, which had been determined upon vessels sold by the Board, so as more nearly to represent the cost of insurance in the world's markets. A general reduction in rates was felt to be impossible, in view of the demoralized condition of the marine insurance markets of the world and that business is being done in foreign markets at rates considerably below what has been current for some years, although the weight of evidence is that the hull business for those years was done at a loss. However, a plan has been formulated to help meet the Board's predicament, which briefly is as follows:

1. Where a private owner's interest is written in "C," the same rates will be quoted in "B" for the Government's interest.
2. Where a private owner's interest is placed with underwriters other than "C," Syndicate "B" will quote for the Government's interest the same rates as would have been quoted for the owner's interest, if insured with Syndicate "C."

All obligations to place such insurance with "B" are suspended and the Government and owners are at liberty to place the insurance in the world market, if so decided in each case by the Shipping Board.

Salvage Association Results

IN a summary of the minutes of the annual meeting of the United States Salvage Association, Inc., Acting Manager Lawrence J. Brengle states that the major part of the work of organization has been in the foreign field. Up to March 1, 1922, the Association had appointed agents at 88 ports. "South and Central America and the West Indies are practically completed," said he, "and our representatives in the United Kingdom, France, Spain, Portugal, Norway and Sweden are likewise established at practically all the important ports. Our main efforts at present are directed at finding suitable agents in Germany, the Levant, Africa, Asia and in the East Indies."

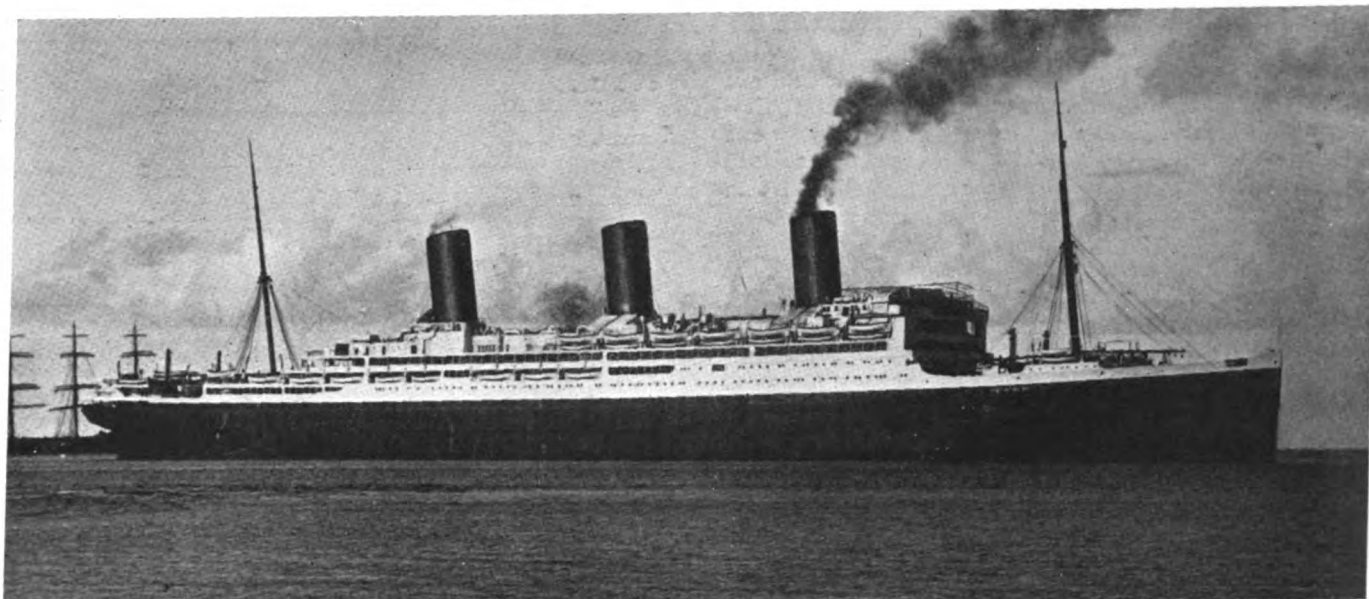
Foreign agents have handled nearly 50 damage cases for the Association. Since beginning business on November 1, 1921, a total of 3,049 damage surveys were handled by the Association's branch offices and agencies in the United States, up to February 1, 1922. Included in this total were 786 damage surveys for private account, and 2,263 for the United States Shipping Board. New York produced the greatest amount of work, having made 1,194 surveys; New Orleans, 441; Norfolk, 321; Baltimore, 217; Galveston, 201; Boston, 159; Savannah, 152; Seattle, 61; and San Francisco, 47. There are now 435 Shipping Board vessels in commission, and on these vessels alone the Association's surveyors are making an average of 150 damage surveys and 100 condition surveys per month.

Masters' Insurance Opposed

ADVENTURESOME British insurance company plans to issue a form of unemployment insurance for ship masters when disqualified for service because of an accident, but the proposal is meeting with little support in this country. Our underwriters see in the proposition an avenue for an increase in moral hazards as respects ocean hull and cargo insurance. Guaranteed that their actions are protected by insurance against personal financial loss, unscrupulous masters might easily detect in this device a way to comfortable retirement through the means of a fortunate "accident" at sea.



White Star Liner Majestic: (1) Corner of Lounge, Showing Carved Oak Paneling; (2) Fireplace in Smoking Room; (3) View in Main Dining Room; (4) Sun Veranda of Private Suite; (5) Windows of Private Sun Verandas Have Garden Boxes; (6) In the Palm Court; (7) Writing Desk in Private Drawing Room



White Star Liner Majestic, the Largest Vessel in the World

The New White Star Liner Majestic

**World's Largest Steamship Enters Transatlantic Express
Passenger Service — Details of Hull and Machinery**

ANOTHER step in the development of the transatlantic liner has been reached by the completion of the *Majestic* of the White Star Line, which arrived in New York on her maiden voyage on May 16. Although falling short of the 1,000-foot liner so often dreamed of and discussed in marine circles in recent years, nevertheless the *Majestic* with her overall length of 956 feet and her gross tonnage of 56,000 surpasses in size any other vessel afloat and with her conversion, before completion, from a coal burning to an oil burning vessel she bids fair to be classed as one of the speediest vessels in the North Atlantic service.

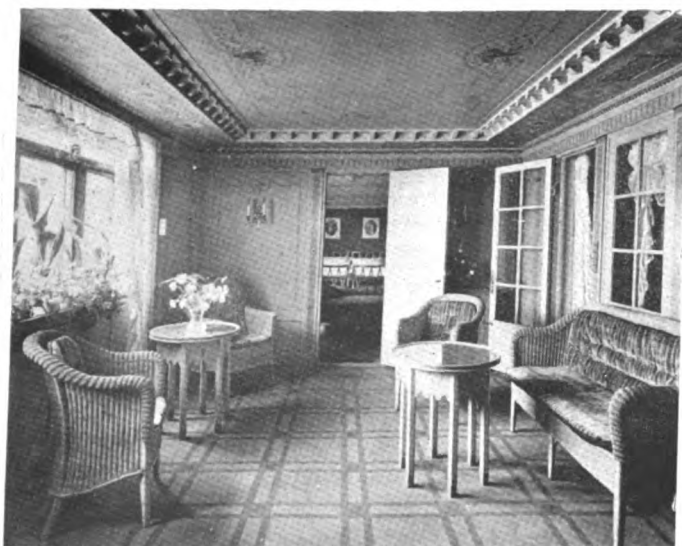
Designed originally for the Hamburg-American Line, the *Majestic* was built in Germany at the yards of Blohm and Voss in Hamburg and, when launched in 1914, was christened the *Bismarck*. With the outbreak of war the construc-

tion of the vessel was suspended, but after the armistice was signed she was purchased from the Reparations Committee by her present owners.

The principal dimensions of the *Majestic* are as follows:

Length overall	956 feet
Length between perpendiculars	912 feet
Beam	100 feet
Depth, molded	57.1 feet
Gross tonnage	56,000
Horsepower, designed	66,000
Speed, designed	23½ knots
Number of passengers	4,100

With accommodations for 4,100 passengers, the *Majestic* has nine decks, five of which run the full length of the ship, four being in the superstructure. These four superstructure decks occupy about a third of the ship's length and contain



Private Sun Veranda



Swimming Pool



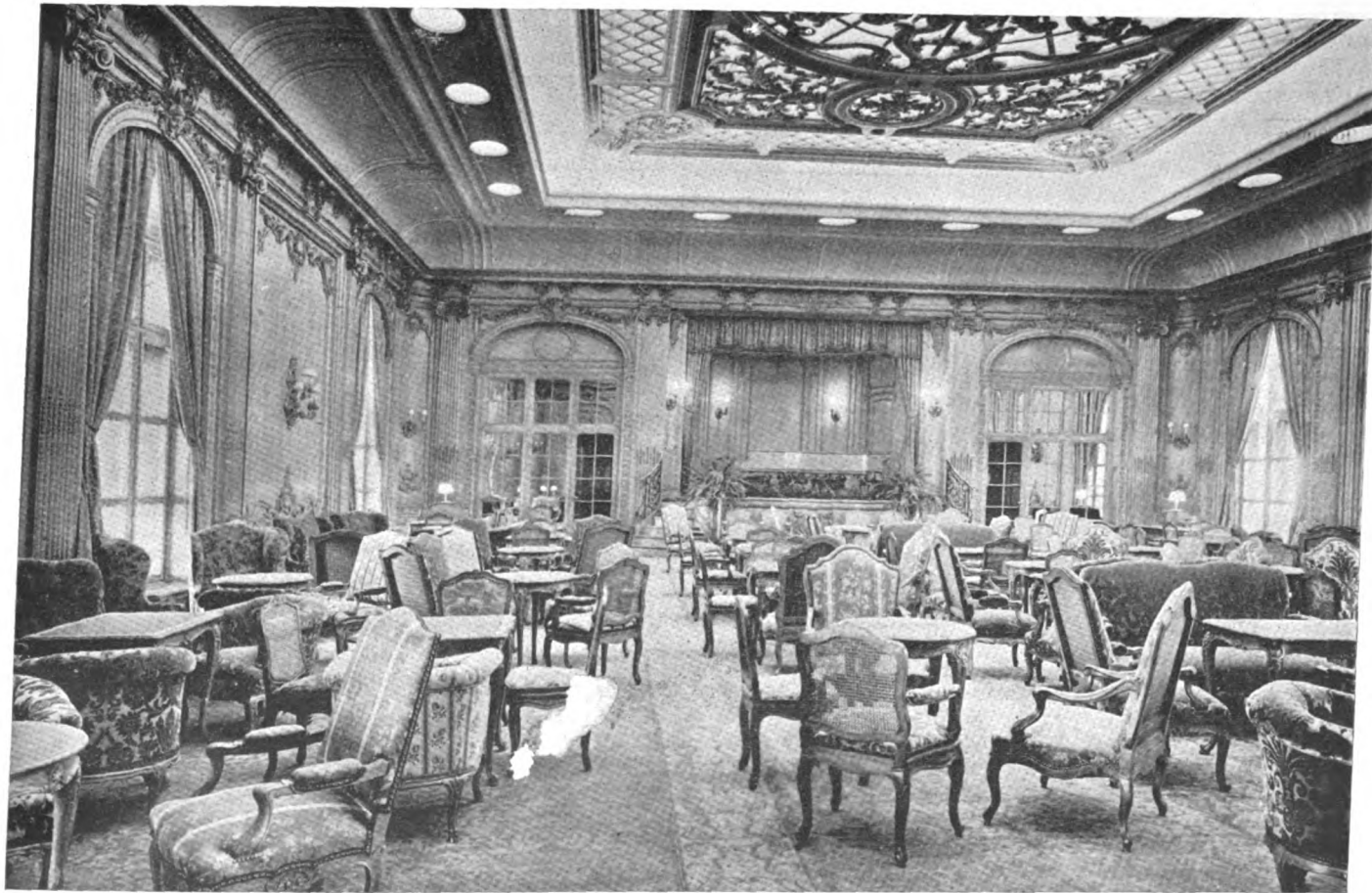
Palm Court, Adjoining the a la carte Restaurant



Main Dining Room



Grand Foyer



The Lounge, the Largest of the Majestic's Public Rooms

cabins and public rooms. Seven of the decks are devoted entirely to the accommodation of passengers. Because of the fact that the stacks are divided below decks and brought up the sides of the vessel it has been possible to provide a broad central foyer through the upper decks, unlike that on any other ship now in commission. Electric elevators and broad staircases of easy pitch connecting all decks are intended to minimize fatigue to the passengers.

LUXURIOUS PUBLIC ROOMS

On the promenade deck are the main first class public rooms, which, in proportions and elegance, are in keeping with the size and dignity of the ship. The principal rooms occupy a continuous steel deck house two stories high.

From the central foyer on *B* deck entrance is obtained on the one hand to the lounge and on the other to a spacious palm court leading to the *a la carte* restaurant. Here again advantage is taken of the fact that the boiler casings are divided to provide a clear space of 250 feet extending through these rooms. Forward of the lounge is a reading and writing room and above that the smoking room. The main first cabin dining saloon is on *F* deck with the central part extending to *E* deck, the ceiling being 31 feet high, the loftiest on any ship afloat. The dining room is 98 feet by 117 feet and seats 652 persons. The *a la carte* restaurant accommodates 200 more.

The lounge is 54 feet by 76 feet; its ceiling is 26 feet high. This room is distinguished by its perfect symmetry, unbroken by bays, projections or roof supports, by the beauty of its oak paneled walls and by the tall French windows. At one end of the lounge there is a concert stage and a large dancing floor which is in use nightly.

Possibly the most striking single feature of the *Majestic's* interior is the Pompeian swimming bath which is decorated with rich marbles and brilliant mosaics. The tiled pool has an area of 820 square feet and a depth of from 4 feet to 9 feet.

STATEROOM ACCOMMODATIONS

The *Majestic* has a passenger capacity of 4,100 and for their accommodation 1,245 staterooms are provided of which 472 are in the first class. Many of the first class rooms are in suites that approach in size and equal in luxury the finest apartments ashore. The two largest suites include 8 rooms each with 3 baths.

The *Majestic* is fitted with all the latest accessories and comforts for passengers of all classes. Both steam and electricity are employed for heating the public rooms and staterooms. The ventilation system automatically assures a constant supply of fresh air at the proper temperature to all parts of the ship.

Each class of passengers on the *Majestic* has its own galley, pantry, culinary and service staff. There are no less than eight galleys on the ship.

The second and third cabin accommodations are unusually fine. The second cabin dining saloon, seating 400, has direct communication by electric elevator to the second cabin lounge, reading rooms and foyer. The third class also has a lounge, smoking room and dining saloon and many airy well-lighted two, three and four-berth staterooms.

PROPELLING MACHINERY

Through the courtesy of Joseph Wolff, chief engineer of the *Majestic*, we are enabled to present the following notes on the main features of the vessel's propelling machinery:

Propulsion is by four screws driven by Parsons reaction type turbines. There are four sets of ahead turbines and four of reversing turbines. Both ahead and astern turbines are connected to the same shaft in each set. The engines are rated by the builders as capable of developing 66,000 shaft horsepower at 180 revolutions per minute but on the ship's trial trip in the North Sea in April it was found that they developed about 80,000 shaft horsepower at this speed.

The astern turbines developed 36,000 shaft horsepower. The steam pressure on the trials was 16 atmospheres or 240 pounds per square inch gage.

The ahead turbines work in series when the vessel is at full speed, the steam passing from the high pressure turbine on the port inboard shaft to the intermediate pressure turbine driving the starboard inboard shaft and thence to the low pressure turbines each driving an outboard shaft. The astern turbines also work in series, the high pressure in each case being on the inboard shaft and the low pressure on an outboard shaft.

The weight of the turbines with their shafts is 3,400 tons. The shafts are 16½ inches diameter. The propellers are four-bladed each with a diameter of 16 feet 6 inches and a pitch of 14 feet 11.5 inches.

Steam is supplied by 48 oil burning Yarrow type watertube boilers, having a total heating surface of 220,000 square feet. The boilers work under forced draft and are fitted with Mumford automatic feed regulators. The fuel oil is burned through the White low pressure system. In all, there are 240 oil burners or five to each boiler. Owing to the character of the system employed, the temperature in the firerooms is no higher than that in the engine rooms. One fireroom attendant has charge of three boilers or fifteen burners. With three watches in 24 hours, only 48 attendants are required to man the fires. There are also employed in the firerooms, however, 36 cleaners, making a total fireroom staff of 84 men as against a staff of 377 which would have been required had the ship burned coal. The latter number would have been represented by 12 chief stokers, 197 firemen and 168 coal passers.

The engine room force on the *Majestic* comprises 70 engineers of all classes, 42 oilers and 4 storekeepers. The engineers include the chief, a staff chief engineer who stands next to the chief in authority, a senior, intermediate and junior with their assistants in each of the three grades, namely: second, third and fourth, besides three electrical, three deck, three sanitary, three hydraulic, one Diesel and others specializing in refrigeration.

The fuel consumption on the *Majestic* has not yet been accurately determined but on the Atlantic passage it will approximate about 800 tons of oil a day at ordinary service speed. Should the vessel be driven to her capacity, the consumption would rise somewhat disproportionately for the added speed secured above her normal rate, which is expected to be about 25 knots. With an oil bunker capacity of 8,200 tons, the *Majestic* will carry nearly enough oil on one filling to make the round voyage between Southampton and New York.

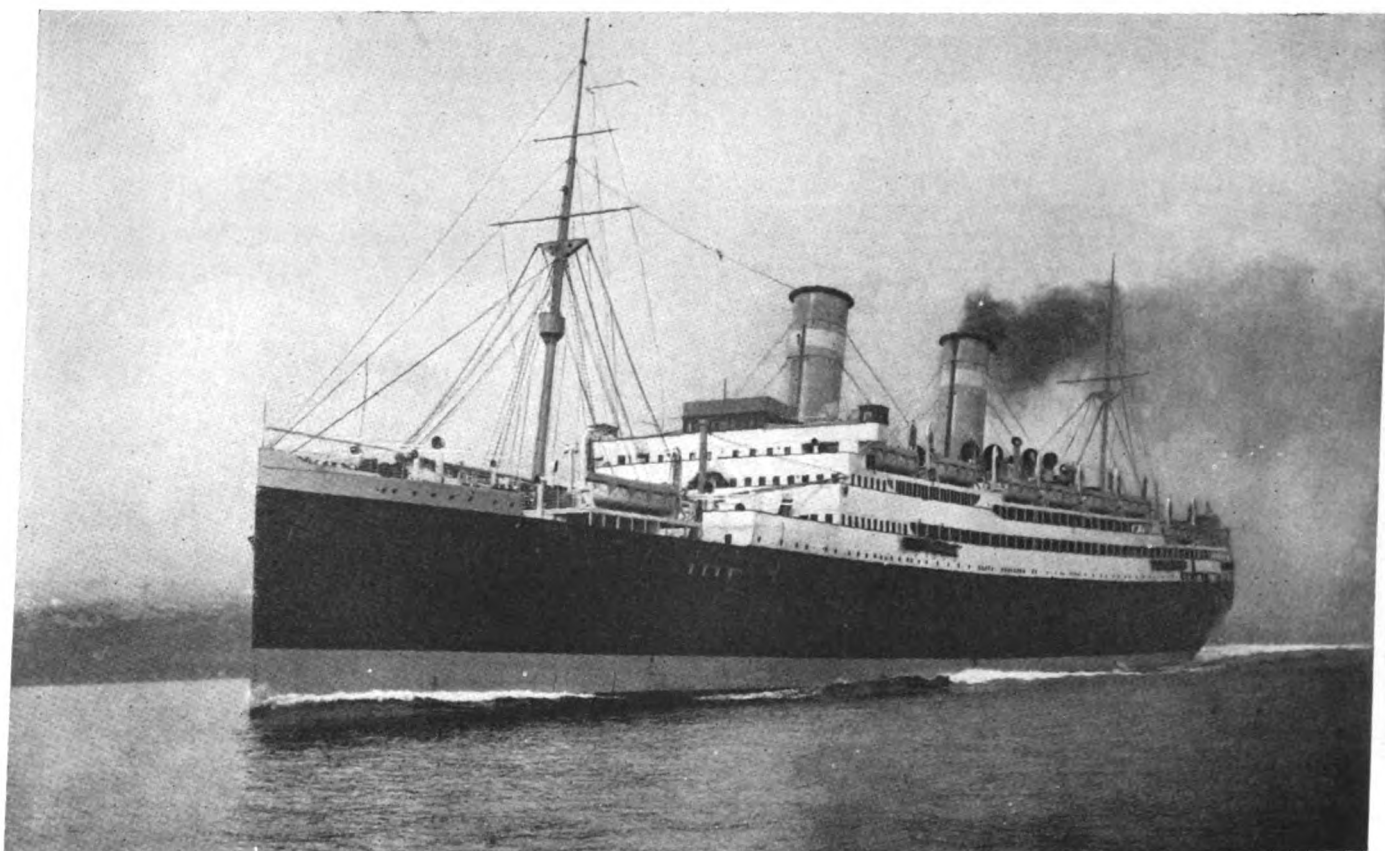
The weight of the complete main engine and boiler plant totals 8,500 tons.

AUXILIARY MACHINERY

The *Majestic's* auxiliary equipment is unusually large and diversified and includes a Diesel engine-driven 90-kilowatt generator installed 19 feet above the bulkhead deck for supplying current not only for 800 emergency lights distributed all over the ship but also for lowering the lifeboats and for the navigating, signalling and emergency wireless equipment.

The main electrical plant consists of five turbo generator sets, each of which develops 288 kilowatts at 115 volts at 2,000 revolutions per minute. Current from the main switchboard is distributed by 32 feed cables, 22 of which are for power purposes, 6 for lighting and 4 for heating. In all, there are 225 electric motors on the ship with a collective capacity of 1,565 horsepower.

Special attention has been given to the heating and ventilating and refrigerating equipment on board. Steam-driven CO₂ refrigerating machinery is installed for the provision storerooms while an electrically-driven refrigerating installation is provided for the refrigerated cargo in the forward part of the vessel.



Combined Passenger and Cargo Liner Conte Rosso

New Italian Liner Conte Rosso

**Passenger Vessel Built in England for Lloyd
Sabaudo Has Unusually Luxurious Appointments**

THE new Italian liner *Conte Rosso* which has recently been completed in the shipbuilding plant of William Beardmore & Company, Ltd., at Dalmuir, Scotland, will shortly take her place in the service of Lloyd Sabaudo Company of Genoa, Italy, which will employ her in its passenger and cargo service between Italy, South America and North America.

The vessel is of the shelter deck type without tonnage openings and was built under special survey to the highest class of Lloyd's Register, the British Corporation and the Register Navale Italiano. The requirements of the International Convention for the Safety of Life at Sea have also been complied with and due consideration given the design of the vessel in order to build it in accordance with the latest regulations of the Italian and American immigration laws.

Designed with a straight stem well raked forward, an elliptical stern with the lower portion bossed out to provide a space for the steering gear, two funnels and two pole masts, the vessel has an exceedingly trim appearance that pleases the eye and conforms to the standards of a well designed ship.

Twin screws are used to drive the vessel in service at a speed of $18\frac{1}{2}$ knots and the main propelling units of geared turbines will develop approximately 17,000 horsepower at this speed.

DECORATIONS

The outstanding feature of this remarkable new vessel is the comfort, convenience and elegance contained in the pub-

lic rooms and passenger accommodations. The result attained in these quarters represents a marked advance in the appointments provided on passenger ships and will no doubt establish a new precedent in the decoration and arrangement of these spaces on future vessels.

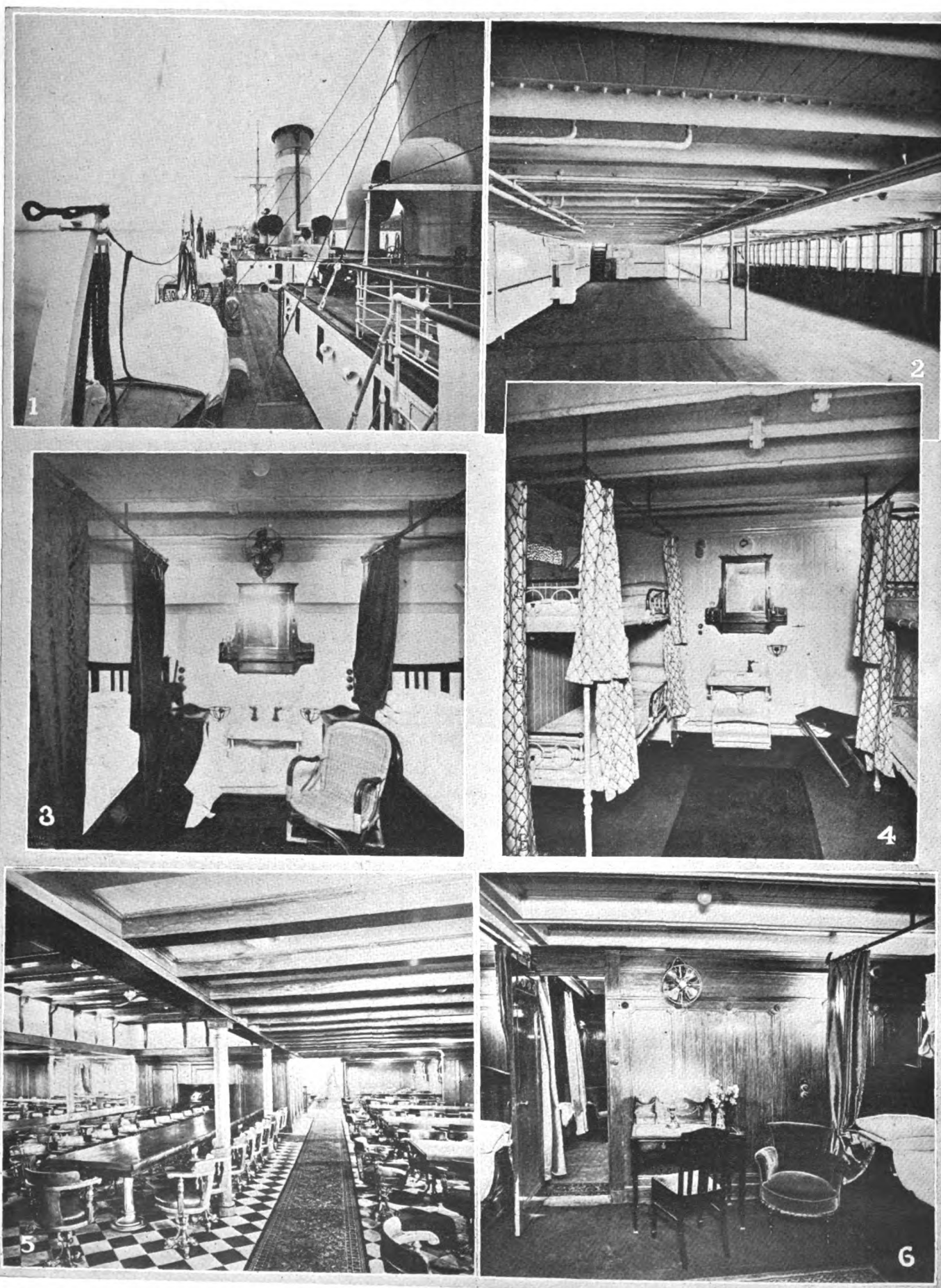
In conformance with the expressed desire of the owners to incorporate in the decorative scheme their experience of the requirements of the Italian and South American service, the whole of the decoration of the first class public rooms was entrusted to the firm of Messrs. Coppede of Florence. These rooms are decorated in a most beautiful and artistic manner that will satisfy the most fastidious. The discriminating traveler will be assured of delightful surroundings during the voyage.

The main entrance hall is in the style of the Italian Renaissance in oak and mahogany. Hand carvings, inlaid work, tapestry and stained glass all play a part in the general scheme.

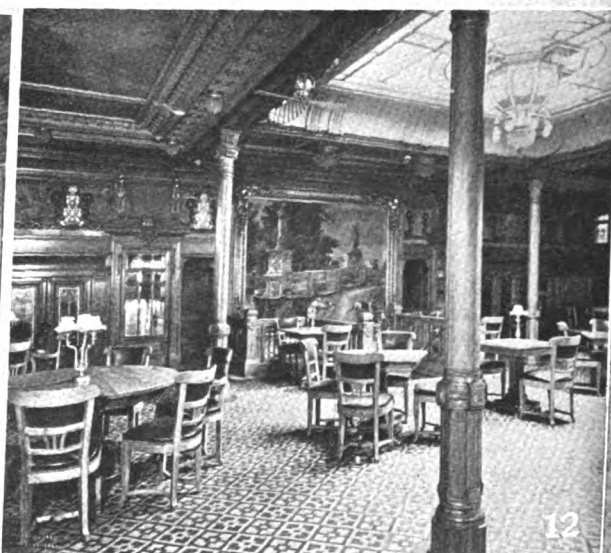
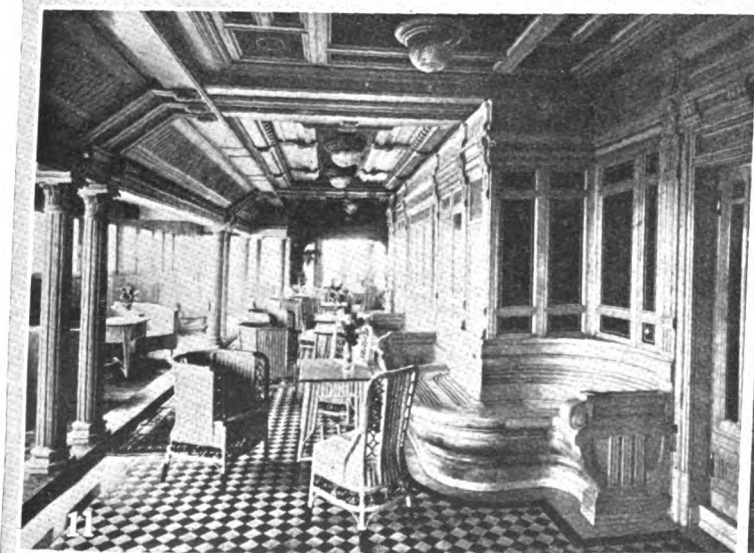
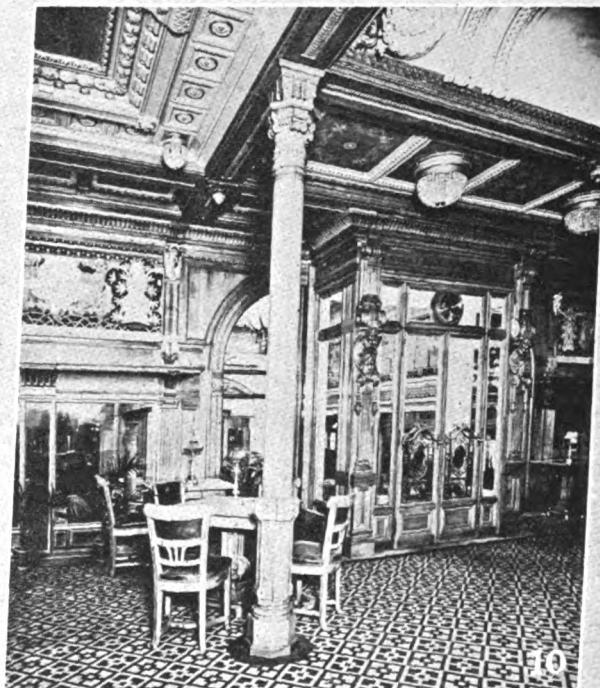
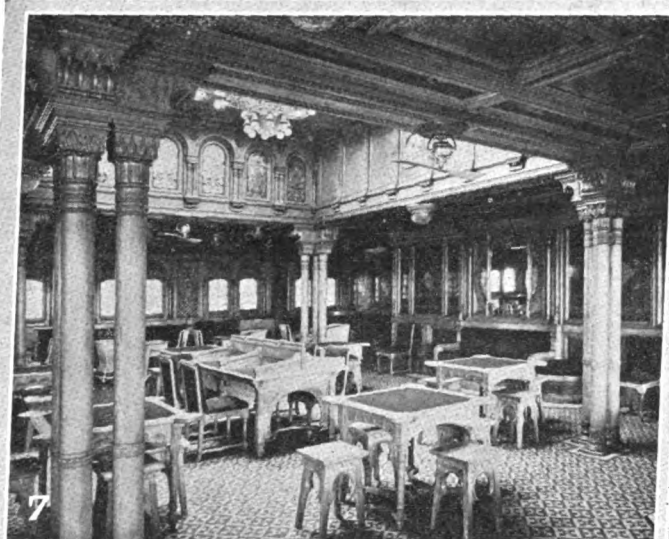
In the library, the style follows that of the Tuscan Renaissance, the woodwork being polished walnut finely carved and inlaid. A frieze runs around the sides and embodied in the general scheme are some 50 sea and landscape paintings. In lieu of the usual ceiling lamps four wrought iron electric standards with six lights each are located on the deck and each reading and writing table is provided with an individual lamp.

A music room is provided which is arranged and decorated in Pompeian style.

The dining rooms are arranged on two decks, the upper



Italian Liner Conte Rosso: (1) Boat Deck, Aft; (2) Promenade Deck; (3) First Class Stateroom for Two; (4) Second Class Stateroom; (5) Second Class Dining Room; (6) Cabin de Luxe



Italian Liner Conte Rosso (First Class Public Rooms); (7) Smoking Room; (8) Library; (9) Music Room; (10) Entrance to Main Dining Room; (11) Veranda Café; (12) Upper Dining Room

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providing seating accommodations for 72 persons arranged at tables for two, four and six. This room is decorated in the style of the Italian Renaissance and around the sides is a dado carved with tooled and gilt leather panels. Two large pictures of war episodes in the life of Conte Rosso recall the history of the man after whom the vessel is named. The lower dining saloon has seating accommodations for 176 passengers and the decorative scheme is similar to that in the upper dining saloon. One of the distinctive features of the lower dining saloon is a painting by Professor Cavalieri, one of Italy's foremost artists, representing the triumphal return of Conte Rosso to Nice in 1838.

The smoking room is decorated in the Moorish style of the Alcazar in Seville. Mahogany and chestnut are blended with very fine workmanship.

The veranda cafe is decorated in white maple in a modern style of simplicity which gives prominence to the fine grain of the wood.

ACCOMMODATIONS

Accommodation is provided for 208 first class passengers, 268 second class passengers, 1,890 immigrants and 442 officers and crew. An alternative arrangement of cabins is provided for, however, on the upper deck whereby the number of first class passengers can be reduced to 160 and the number of second class passengers increased to 364.

First class cabins are exceptionally large and include six cabins de luxe on the bridge deck, each of which is fitted with private bath and a constant supply of fresh hot and cold water. The woodwork in these cabins consists of framed and panelled mahogany and the furniture of polished African walnut including two large wooden beds, dressing table, writing table and chair, wardrobe and two easy chairs. Doors are fitted to adjoining cabins so arranged as to accommodate families en suite.

On the bridge deck amidships are provided forty-two single berth cabins. Twelve large special cabins for two per-

sons each are arranged on the promenade deck and eleven similar cabins on the upper promenade deck. A feature of the first class staterooms is the fact that with the exception of those fitted for conversion to either first or second class they are provided with beds in each case, no upper berths being fitted. Another feature is that, wherever practicable, intercommunicating doors have been provided between the cabins and each cabin is supplied with a hot and cold fresh water service.

Second class passengers are carried in four-berth cabins, some of which are located on the upper deck, some on the shelter deck amidships and the remainder in the after portion of the bridge deck.

The second class dining room, which provides for a seating capacity of 254 persons, is located on the promenade deck aft and the smoking room for the second class passengers is on the same deck at the extreme after end.

Sleeping accommodations for immigrants are located on the upper and main decks, both forward and aft, and a dining room with a seating capacity of 450 is located on the shelter deck forward. Promenade space for immigrants is provided forward of the dining space and an open promenade above on the bridge deck.

Another of the new innovations incorporated in the design of this vessel is the location of the first and second class galleys on the boat deck. A special advantage of this arrangement is that the locating of the galleys above the level of the public rooms does away with the smell of cooking in the latter. Service hoists are provided which convey food from the galleys to the dining saloons.

The *Conte Rosso* is the newest type of combined passenger-cargo liner, which has found so much favor in recent years, to be launched. The owners have spared no expense in making this vessel one of the finest of its type afloat and there is no doubt but what their efforts will be well received by the passengers who travel the route over which the vessel plies.

Sternwheel Towboat for Mississippi River Service

Steel Western River Steamer to Be Used for Towing Oil Barges at New Orleans—Boilers to Be Oil Fired

THE Charles Ward Engineering Works, Charleston, W. Va., is constructing for service on the Mississippi River and the bayous in the vicinity of New Orleans a sternwheel towboat from designs prepared by Cox & Stevens, naval architects, New York, to the order of the Pan American Petroleum & Transport Company. The vessel, which will be used to tow oil barges from South Pass to points on the river and Bayou La Touche, has the following dimensions:

Length on deck	136 feet 5 3/16 inches
Length, overall	159 feet 8 13/16 inches
Beam, molded	32 feet 0 inches
Beam, overall	32 feet 8 3/4 inches
Depth, molded	5 feet 6 inches
Crown of deck	5 inches
Draft, mean, with 50 tons of fuel	48 inches

GENERAL ARRANGEMENT

The boat is equipped with all modern conveniences for efficient operation and the comfort of the crew, including modern plumbing, hot and cold water, steam heat, electric fans, door and window screens and social hall.

The hull and main deck house are of steel construction. Longitudinal strength is obtained by means of five longi-

tudinal hull and two deck trusses. The deck trusses continue aft and form part of the long cylinder beams supporting the paddle wheel. Six transverse bulkheads divide the hull into seven compartments, one of which is utilized for a fuel oil tank.

The bow of the boat is of the modified scow form.

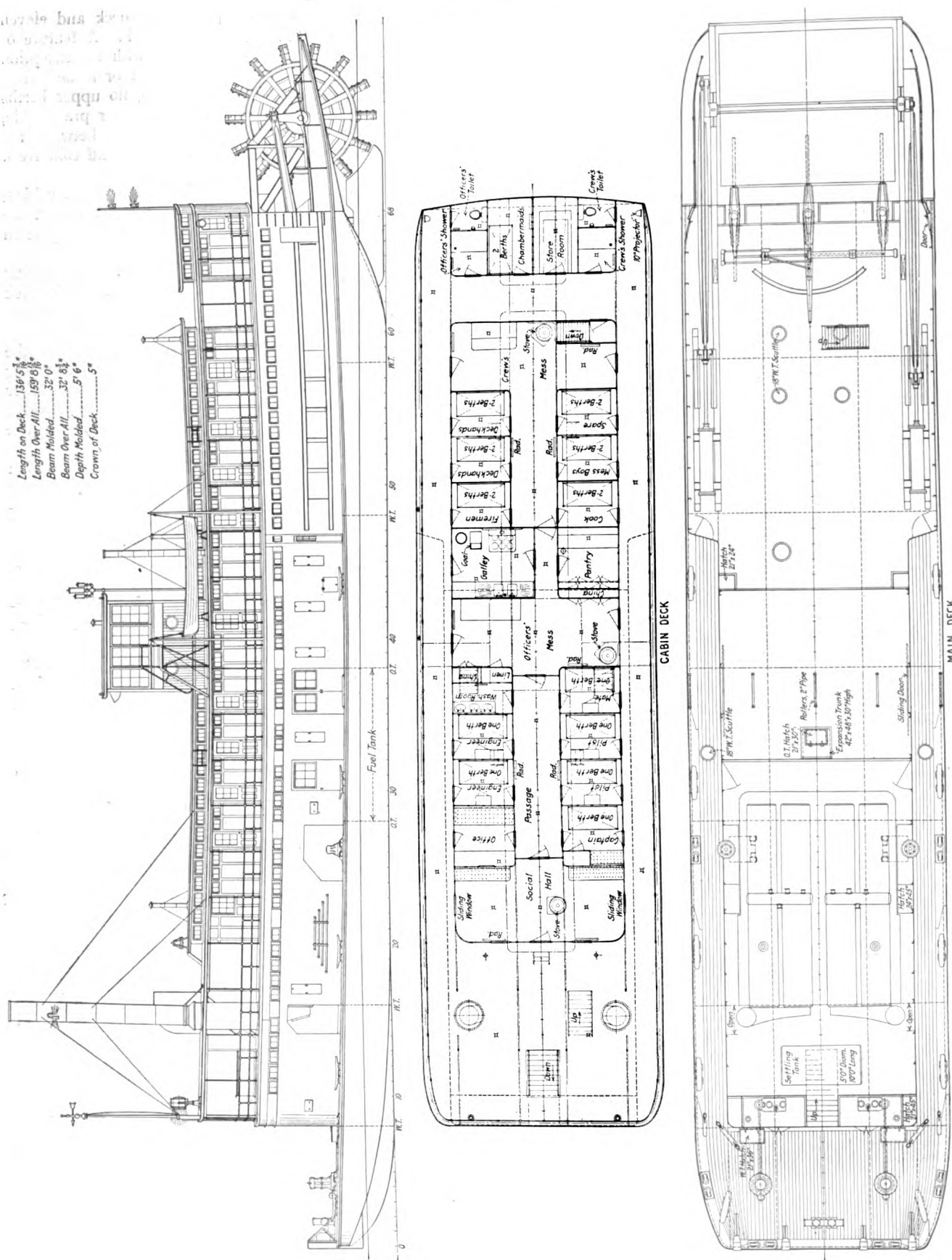
PROPELLING MACHINERY

The propelling machinery is of the high pressure non-condensing type with cylinders 18 inches in diameter by 7 feet stroke with balanced poppet valves and "California" cut-off gear as manufactured by the Charles Barnes Company of Cincinnati, O. The paddle wheel is 21 feet in diameter by 22 feet 6 inches long and has 14 buckets 36 inches in width.

AUXILIARY MACHINERY

Two horizontal duplex plunger boiler feeders receive water from an open cold well connected to intakes located above the rounded bilge of the hull.

A duplex pressure coil heater is installed in the exhaust line common to both propelling engines. The surplus exhaust steam is carried to the stacks to increase the draft, or to the

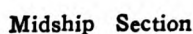


atmosphere, as desired. The boiler feed lines are installed inside the exhaust line to supplement the heating surface of the feed water heater.

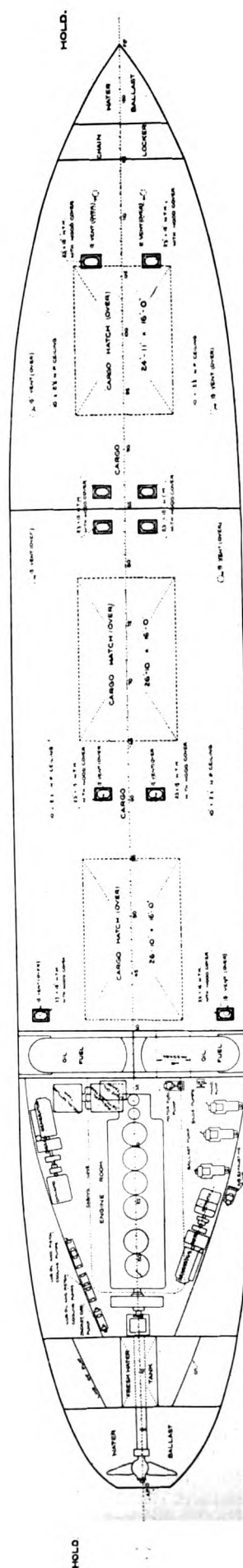
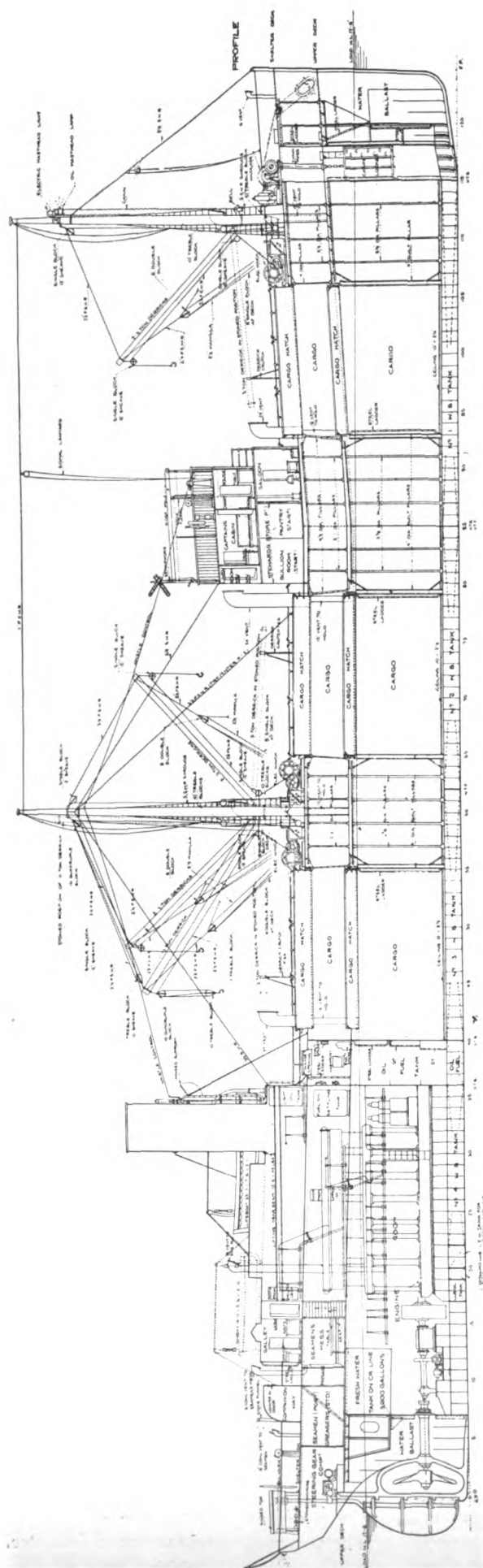
A 15-kilowatt generator and sanitary pump complete the equipment. The hull compartments are unwatered by means of syphons.

The boilers are of the horizontal flue type arranged in two batteries with two boilers in each battery. They are 40 inches in diameter by 28 feet long with five 9-inch flues in each, designed for a steam pressure of 220 pounds per square inch. Oil is used for fuel.

Two double drum, double purchase capstans are located



The boat will tow from one to four steel oil barges having
(Continued on page 400)



Figs. 1 and 2.—General Arrangement Plans of Single Screw Motorship Pinzon

Diesel Machinery for Single Screw Motorships*

General Problems Involved in Application of Single Motor to Vessels Over 2,000 Tons Deadweight—Details of Motorship Pinzon

By James Richardson, B.Sc.

NOTWITHSTANDING the vast increase in the number of ships fitted with internal combustion engines, single screw motorships of 2,000 tons deadweight and over have hitherto been exceptional. Increasing confidence in the Diesel engine as a reliable and satisfactory prime mover for marine propulsion, and the desire to take advantage of its economies in classes of vessels of low power, where the single screw arrangement is almost the only one permissible, have recently brought this subject into prominence. In discussing the general problems involved in the application of a single motor in ships of this size, as is the intention of the author in this paper, it may be helpful to give at the outset details of such a vessel.

Figs. 1 and 2 show the general arrangement and Table I gives the leading characteristics of the machinery and equipment of the single screw motorship *Pinzon*, built and engined by Messrs. William Beardmore & Company, Ltd., of Dalmuir. All deck and engine room auxiliaries are electrically driven. No boiler is fitted. The total consumption of fuel oil for all purposes in this ship at 9, 10 and 11 knots at sea, fully laden, in reasonably good weather is 3, 4 and 5.1 tons per day respectively, as given in Table II. The results of the machinery trials are shown by the curve in Fig. 3, and the main engine indicator diagrams are reproduced in Fig. 4.

In connection with the diagrams, attention may be directed to two points. Firstly, the very flat fuel consumption curve which lies below the 0.5 pound per brake horsepower per hour for the main engines, for speeds from a maximum of 125 revolutions per minute to 81 revolutions per minute, i.e., from over 1,400 brake horsepower to 420 brake horsepower. Secondly, an inspection of all the indicator cards shows from the toe of the diagram the very rapid release of the exhaust gases. The pressure drops to atmospheric almost before the bottom dead center is passed. This result is due to the large valve areas possible with the well-known Tosi arrangement of combined inlet and exhaust valves with the director valve controlling the exhaust gases and induction air. A further feature of this system is the extremely low exhaust temperatures, which never exceed 560 degrees F., although measured in the stream of the gases in the cylinder head.

Broadly stated, above 7,000 tons deadweight and 11 knots speed there is a good case for the retention of the standard twin screw arrangement of oil engines because of the lower total cost, the reduced weight of machinery, the shorter length of engine room, which compensates for the cargo space taken up by the extra shaft tunnel, and the reduced risks of breakdown. The personnel, however, is increased.

PROBLEMS INHERENT TO SINGLE SCREW DIESEL MACHINERY

Turning in detail to the problems inherent to single screw Diesel machinery, it may be said first that the dictates of reliability and the limited man power available on board demand that certain operations shall be made possible and certain conditions fulfilled.

(1) The crankshaft shall be capable of being removed and replaced with the minimum dismantling of the main engine parts. As an alternative, the after length of the crankshaft, being the

more liable to breakdown, shall be so accessible that it can be readily removed and replaced.

(2) That part of the fuel injection air service common to all the main engine cylinders should be in duplicate, including the blast bottle, so that failure of any pipe, joint, valve or chest, etc., shall not necessitate, at most, more than a momentary stoppage.

(3) Arrangements must be made so that all the valves in the cylinder head can be rotated on their seats by hand.

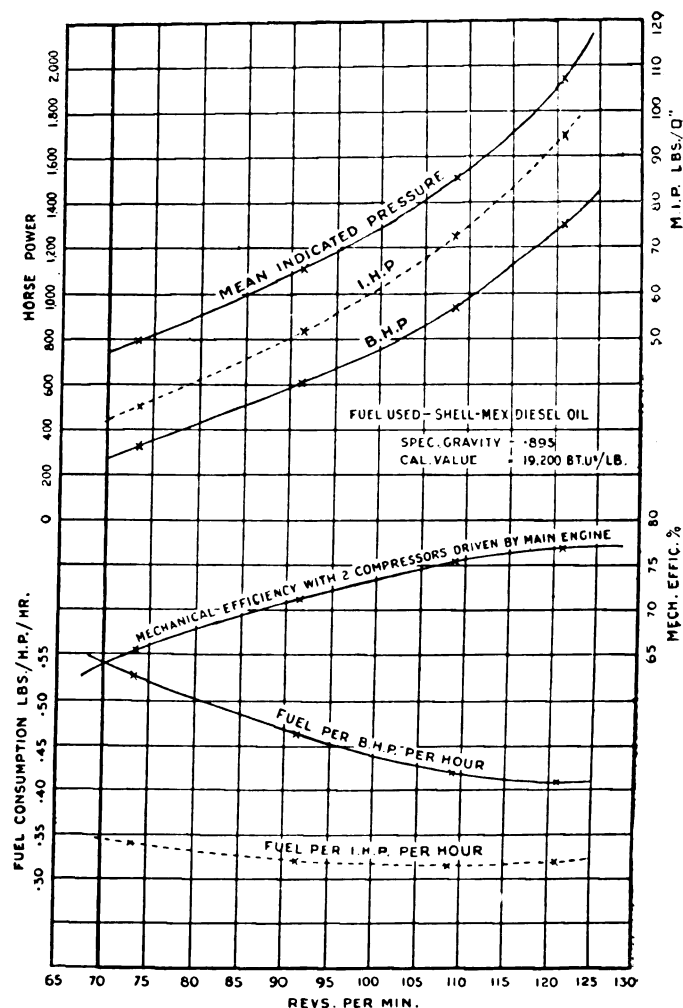


Fig. 3.—Trial Results of Beardmore-Tosi Diesel Engine, M. S. Pinzon

(4) All the main parts, including pistons, must be completely accessible.

(5) The failure of any one or two fuel pumps, supplying fuel under pressure to the main cylinders, must not necessitate a stoppage.

(6) The subject of main engine flexibility, the maneuvering gear, valve setting, and the proportioning of the flywheel, and the whole question of starting or maneuvering air supply must have greater attention than in the case of a twin-engined vessel.

(7) The engine shall be capable of being readily maneuvered by one operator.

As with steam installations, so with motor machinery, the subject of the auxiliaries, both deck and engine room, is only now receiving the attention demanded by its vital importance.

*Paper read at the sixty-third session of the Institution of Naval Architects, London, April, 1922.

1 ST RUN M.I.P. = 52.2 R.P.M. = 72.7 I.H.P. = 85 MAX. PRES. = 465 TOTAL I.H.P. = 500 " B.H.P. = 335	2 ND RUN M.I.P. = 67.5 R.P.M. = 93 I.H.P. = 141 MAX. PRES. = 480 TOTAL I.H.P. = 860 " B.H.P. = 630	3 RD RUN M.I.P. = 85.5 R.P.M. = 109 I.H.P. = 210 MAX. PRES. = 495 TOTAL I.H.P. = 1272 " B.H.P. = 960	4 TH RUN M.I.P. = 103.5 R.P.M. = 121 I.H.P. = 282 MAX. PRES. = 510 TOTAL I.H.P. = 1700 " B.H.P. = 1310	OVERLOAD M.I.P. = 117 R.P.M. = 123 I.H.P. = 324 MAX. PRES. = 540 TOTAL I.H.P. = 1930 " B.H.P. = 1485

Fig. 4.—Beardmore-Tosi Marine Diesel Engine, M. S. Pinzon. Indicator Cards Taken During Progressive Speed Trials

With motorships, the rival claims of an electric or steam drive still form, and are likely to continue to prove, debatable ground. The alternative of an electric engine room and steam-driven deck machinery is possible, and may commend itself in certain cases. In Table III is given a comparison of the consumption of fuel in similar vessels, one a steamer and the other a motorship, on the same trade. The total consumption of coal is five times that of oil (by weight) in the latter taken over a whole voyage, and is achieved by the utilization of all electric machinery for deck and engine room auxiliaries, deriving current from Diesel-driven auxiliaries. With steam auxiliaries on the motorship, on this trade, the fuel consumption would only be one-third (not one-fifth) that of the steamship.

STEAM VS. MOTOR DRIVEN AUXILIARIES

Table III emphasizes clearly the importance in a steamer of the fuel consumption attributable to the auxiliaries generally, and in such conditions as in a coasting trade, in particular, the fuel consumption of the deck machinery. Whereas at sea the ratio of coal to oil for all purposes is 4 to 1, in port this ratio is over 10 to 1, if fires are "banked." A small oil-fired boiler is generally required for the heating of the accommodation and of the oil fuel, although the former can be carried out by electric radiators, and if only a small quantity of oil is carried, exhaust gases can be utilized for heating it.

There is probability of the general adoption in future of a reasonable utilization of waste heat with Diesel marine installations, whereby oil fuel and accommodation heating can be carried out entirely by the main engine exhausts when at sea and partially, at any rate, by the auxiliary exhausts when in port.

The subdivision of the requisite total Diesel electric generator capacity and the desirable margin to be legislated for

is an interesting point. Sometimes two generator engines and in a number of twin screw ships four have been fitted. In Table IV the actual electric loads on the M.S. *Pinzon* under various conditions have been tabulated. In general, three sets are preferred, one to be in action normally at sea and in port, and two when maneuvering or working cargo fully, one serving as a stand-by. Three such sets of 50 kilowatts each meet the case shown in the table and only rarely does the minimum load fall substantially below half the power of one unit, a proportion desirable for good working conditions with such machines.

It is seen that the maneuvering load is the highest, even when it may be arranged that the auxiliary compressor is slowed down, if and when the windlass load comes on, and that the radiators may be cut out, if necessary. The maneuvering load comes within the capacity of two generators.

The greatest individual load is the auxiliary compressor required to make up starting air. This machine is of sufficient capacity to supply the main engine with injection air

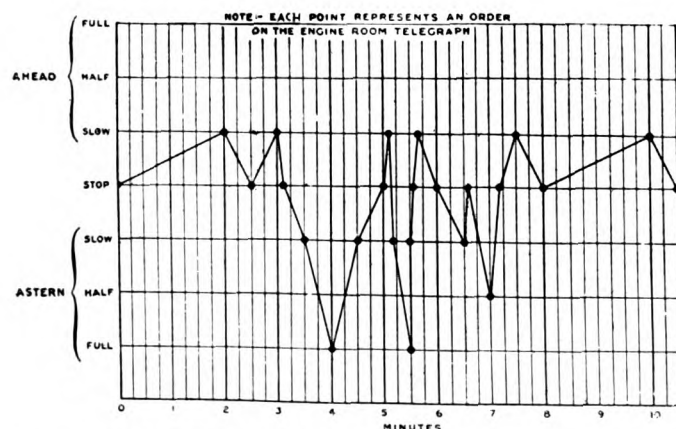


Fig. 5.—Diagram Showing Orders Carried Out on January 13, 1922, Between 6.2 P. M. and 6.125 P. M.

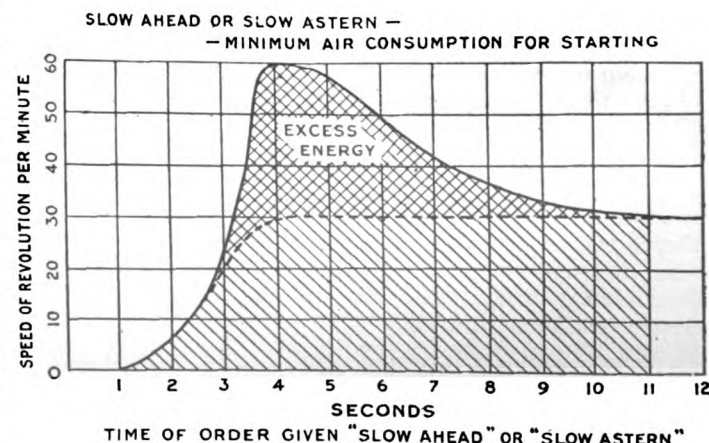
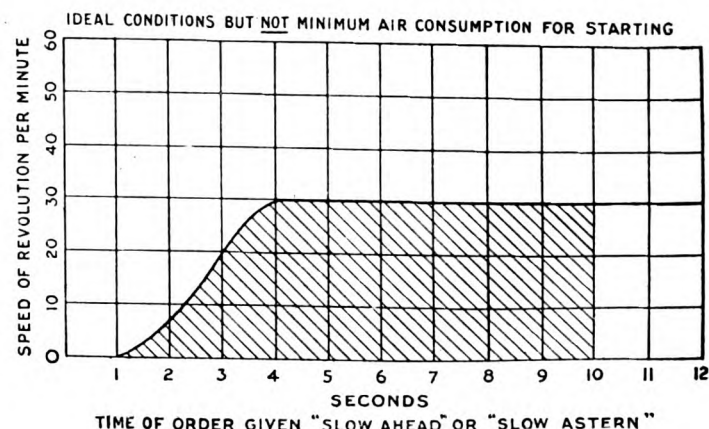


Fig. 6.—Diagrams of Starting, M. S. Pinzon

at full power in emergency, should both the main engine-driven injection compressors be out of action.

STARTING AIR STORAGE CAPACITY

The conservation and replenishment of starting air is a subject of vital importance with internal combustion machinery, as the ability to maneuver the ship is lost if a sufficient quantity and pressure of air are not always available to start the main engine.

Apart from the subject of conservation, reasonably rapid replenishment must be arranged for, as it is possible for a large quantity of air to be lost, as, for instance:

- (i) If the exhaust valve of the cylinder into which starting air is being admitted should be hung open;
- (ii) If one or more starting air valves in the cylinder head hang open;
- (iii) Or, if the engine maneuvering gear should jam in the six or three cylinders on air position and other means not be immediately adopted to shut off the air.

As an example of the demand made upon the starting air storage capacity, two extracts from the log of the M.S. *Pinzon* are given (Tables V and VI) when entering Dalmuir Basin and when navigating up the Bilbao River in Spain. In Fig.

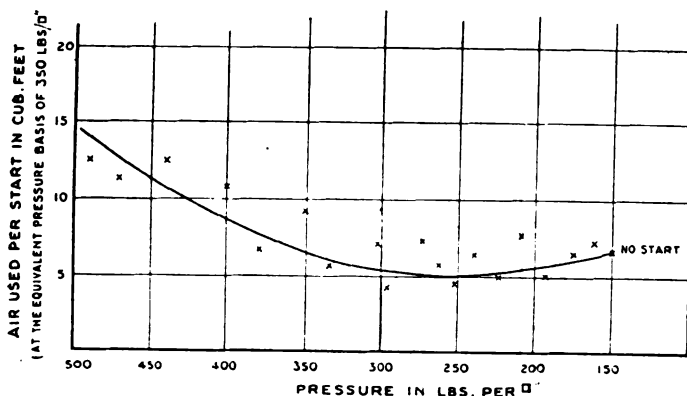


Fig. 7.—Amount of Starting Air Used by Main Engine at Various Pressures of Air Supply

5 is shown diagrammatically 10 minutes of intensive telegraph manipulation involving ten starts of the main engine (extracted from the log given in Table V).

There is one characteristic of these extracts and similar entries in the log to which reference might be made, and that is the prevalence of the repetition of the *motif*, "slow ahead, stop, slow ahead, stop" (see particularly Table VI) having the effect of propelling the ship by repeated thrusts rather than by a sustained effort. It might be suggested that the minimum sustained power possible with the main Diesel engine is excessive. This is not so. The engine has been run for considerable periods at 24 revolutions per minute corresponding to a maximum speed through the water of 2.5 knots, when full way has been obtained, and a piston speed of 150 feet per minute, giving a ratio of maximum to minimum piston speed, or speed of revolution of 122.5 to 24 or 5.2 to 1. It is difficult to foresee any substantial improvement upon this result, since regular firing of the very minute charges of oil fuel can hardly be expected at a lower piston speed, without some substantial increase in complication, as would be involved, for instance, by preheating the induction air.

This extremely and exceptionally low speed of piston of 150 feet per minute is attained by correct combustion-producing means and by the fitting of a flywheel with suitable momentum effect.

FUNCTION OF THE FLYWHEEL

As is now recognized by Lloyd's Register, the fitting of a fully proportioned flywheel isolates the thrust, intermediate

and propeller shafts from the variation of engine-turning moment. The crankshaft is also equally protected from shocks, which might otherwise be transmitted from the propeller. Such a flywheel has no deleterious effects, when starting up or reversing. Momentum is first given by an elastic medium—compressed air—and during a sudden reversal which can be carried out in less than 10 seconds, with full way on the ship, the starting air on being admitted astern, if the engine compression has not already brought the engine to a stop, gently pulls the engine up and gives the initial impulses in the opposite direction.

The diagrams (Fig. 6) show the only remaining justification with modern Diesel engines for the charge of lack of flexibility. When starting up, especially with a view to doing so on the minimum expenditure of compressed air, fuel injection is commenced early and the engine accelerates to "half

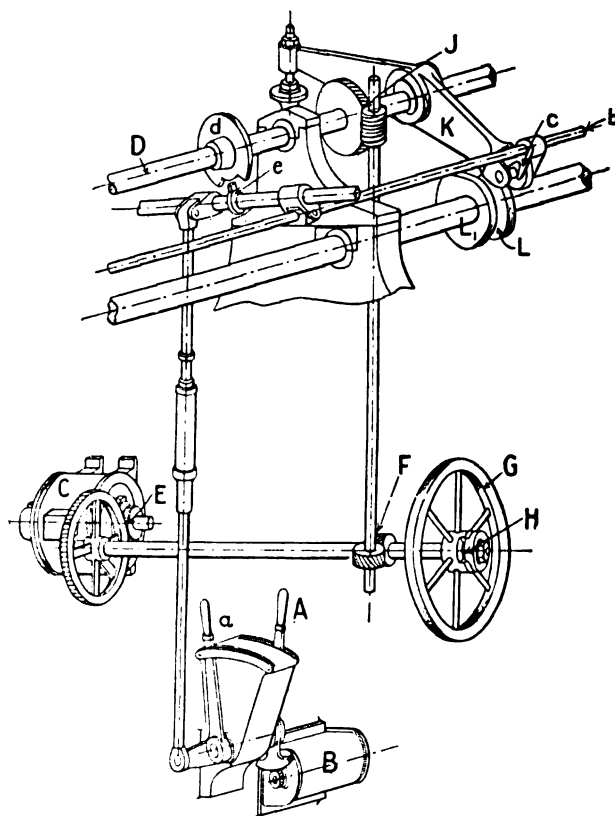


Fig. 8.—Diagrammatic Perspective Arrangement of Beardmore-Tosi Main Engine Starting and Reversing Gear

speed" before retarding to "slow." The total amount of impulse given to the ship is, therefore, approximately twice the ideal. The reconciliation, therefore, of the two somewhat conflicting aims of minimum compressed air used and minimum speed of revolution during starting, without undue complication of the maneuvering gear, is worthy of close study.

It will be found with every type of engine that there is a pressure of compressed air most suitable for starting with the minimum expenditure of air storage energy.

Curves in Fig. 7 show some records and indicate that with pressure between 250 and 350 pounds per square inch the loss of air is a minimum. Whatever the storage pressure—500 pounds per square inch with the *Pinzon*—a reducing valve to ensure that the pressure on the engine side of the air supply is not greater than 350 pounds per square inch, or other means such as working on one of a number of reservoirs, will facilitate the conservation of air.

To consider the replenishment of the storage, Appendix I gives data obtained.

Making the assumption that one start per minute will be the maximum required, over any appreciable length of time, and as the receivers fitted have a capacity of forty starts without recharging—which will cover any exceptional number of starts called for during a short period—it is shown, and has been proved in practice that:

(1) Neglecting the excess injection air from the main engine amounting to 2 cubic feet of free air per revolution of the main engine, there is available air storage and means for replenishment capable of sustaining one maneuver per minute continuously.

(2) If the main engine makes 75 revolutions each move, its excess injection air on being tapped off to the starting bottles will restore what has been taken for the start.

Analyzing a number of logs of "stand-bys," it is found that the average of one maneuver per minute is not exceeded. The average "move," however, is of much less than 75 revolutions, so that actual conditions are a combination of (1) and (2) above, but condition (1) must be satisfied in order:

(a) To give a stand-by in case of breakdown, with the main engine injection compressors.

(b) To cope with the demands for air for starting during a short spell of maneuvering, calling for more than one move per minute, if air has been lost for any reason.

(c) To supply starting air when the main engine injection compressor is either out of action or is working inefficiently and giving no excess air to the starting receivers.

In regard to the actual handling of the engine, see No. (7), page 373, the method of operation and the nature of the gear required will be clear from an inspection of the perspective diagrammatic arrangement given in Fig. 8.

OPERATING GEAR

The starting and reversing of an engine operating on the 4-cycle principle have been brought to the simplest terms, consistent with operation from the usual starting platform. Whatever may be permissible with a twin screw ship, it is considered essential with a single screw installation that the controls should be on the engine room floor level, and the major portion of the gear (as illustrated in Fig. 8) serves to bring the controls to the usual location.

The simplicity of moving the rollers fore and aft, instead of the camshaft, will be appreciated.

Single screw Diesel machinery for the average cargo carrier will be much developed in the near future and the lines of design which will be followed will tend decreasingly to demand a compromise between the best propeller and a smaller and more compact engine, especially with the larger ships.

Speeds of revolution will become standardized as with the steam engine and longer stroke engines will be built. The weight of machinery, the space occupied and the cost will be greater, which will be more than compensated for by the extra accessibility, a built-up crankshaft and a considerably better average propeller performance.

STARTING

The hand lever A controlling the starter B of the 5-brake horsepower electric motor C driving the fulcrum shaft D through the media of spur gearing E, spiral gearing F, to which hand wheel G—the speed revolution of this shaft being suitable—is clutched for hand starting at H, and worm gearing J, effects the starting of the engine by causing one-half revolution of the fulcrum shaft D.

The valve-operating levers K are eccentrically mounted on the fulcrum shaft D, the rotation of which causes their roller ends, for starting, to be depressed on to, or for stopping, raised from their respective cams, L for ahead and L₁ for astern.

This lowering or raising of the roller ends of the valve levers K is carried out in such a sequence, as controlled by

the angle of the eccentrics, to cause the order of starting to be as follows:

Stop—all rollers clear of cams.

6 cylinders on air—6 air valve rollers on cams.

3 cylinders on air; 3 cylinders on fuel—3 air rollers raised and 3 fuel rollers depressed.

6 cylinders on fuel—3 remaining air rollers raised and 3 remaining fuel rollers depressed.

REVERSING

The hand lever *a*, through the medium of links and levers, causes fore and aft movement of the reversing shaft *b*, upon which forks *c* are mounted.

Fore and aft movement of this shaft *b* pulls the rollers along their pins in the wide fork end of the levers K from opposite the ahead cams such as L to opposite the astern cams such as L₁ or vice versa.

A disk *d*, with a gate, is keyed on to the fulcrum shaft D, through which pointer *e* must pass before the rollers can be moved fore and aft for reversal.

The gate in the disk *d* is only opposite the pointer *e* when the valve gear is in the stop position, i.e., all the rollers are clear of the cams.

This is the only interlockment in the gear.

Appendix

M.S. Pinzon—Data Relating to Compressed Air—Time to Start from Conditionally "No Air in Ship."

- (a) When Running the Emergency Compressor of 12 cubic feet per minute swept volume.
Time to fill one blast bottle and one starting bottle for auxiliary generator engine to
800 pounds per square inch = 26 minutes 50 seconds.
1,000 pounds per square inch = 35 minutes 30 seconds.
- (b) When Running the Auxiliary Compressor.
Time to fill one starting air reservoir to 500 pounds per square inch = 19.5 minutes.
Additional time to top up one blast bottle from 500 to 1,000 pounds per square inch = 2.5 minutes.
- (c) Air Available When Maneuvering Main Engine.
Air from one main engine-driven compressor (the other being sufficient for blast supply) = 2 cubic feet per revolution.
Excess air from auxiliary engines (estimated at one-third of air made) = 27.5 cubic feet per minute.
From auxiliary compressor = 176 cubic feet.
- (d) Assuming no air is taken from main compressors, we have 174 cubic feet free air per minute available. This is equivalent to approximately 7 cubic feet air at 350 pounds per square inch per minute. The main engine uses from 5 to 7 cubic feet of air at 350 pounds per square inch per start or reversal, so that there is sufficient air available to allow of one maneuver per minute continuously, neglecting any surplus air made by main engine.
- (e) 70-75 revolutions of main engine supply air for each maneuver (one compressor used wholly for blast), so that, if the main engine is allowed to make 75 revolutions for every maneuver, the starting air can be maintained by the main engine without using any auxiliary supply.

TABLE I.—M. S. PINZON

Particulars of Ship and Machinery—Description.

Ship.—Displacement = 3,300 tons Length = 240 feet. Breadth = 38 feet. Depth = 18 feet.
Winches.—Six fitted, each 16 horsepower.
Windlass.—One fitted, 50 horsepower.
Main Engine.—Beardmore-Tosi 4-cycle, single-acting, 6 cylinder, 629 millimeters (24 3/4 inches) bore; 975 millimeters (38 3/8 inches) stroke; 1,250 brake horsepower at 120 revolutions per minute.
Main Injection Air Compressors.—Two 3-stage. Swept volume per revolution 1 compressor = 2 cubic feet. Swept volume per revolution, 2 compressors = 4 cubic feet.
Auxiliary Compressor.—Three-stage. Capacity first speed = 88 cubic feet per minute free air. Capacity full speed = 176 cubic feet per minute free air.
Emergency Compressor.—Swept volume = 12 cubic feet per minute free air.
Starting Air Receivers.—Three at 70 cubic feet each = 210 cubic feet. Maximum working pressure, 500 pounds per square inch.
Main Engine Blast Bottle.—One working, one spare fitted. Capacity of one bottle = 5 cubic feet. Maximum working pressure, 1,000 pounds per square inch.
Auxiliary Generators.—Two fitted, each 50 kilowatts, Diesel driven. Engines of trunk piston type, 2-cylinder, 4-cycle, 75 brake horsepower, 250 revolutions per minute.
Compressors (Aux. Gen.).—For 1 generator engine, swept volume of compressor at 250 revolutions per minute = 41.2 cubic feet per minute free air. 2 generator engine, swept volume of compressor at 250 revolutions per minute = 82.4 cubic feet per minute free air.
Starting Bottle (Aux. Gen.).—Two per engine capacity = 3.54 cubic feet each. Maximum pressure, 1,000 pounds per square inch.
Blast Bottle (Aux. Gen.).—One per engine capacity = 1 cubic foot each. Maximum pressure, 1,000 pounds per square inch.
Propeller.—Diameter = 12 feet 6 inches. Pitch = 11 feet.

TABLE II.—M.S. PINZON.—RESULTS OF SEA TRIALS

Fuel Consumption per Day (in Tons) for all Purposes.

Speed of ship (fully laden), knots	9	10	11
Revolutions per minute (main engines)	95	105	115
Fuel consumption, all purposes (tons per day)	3	4	5.2

TABLE III.—M. S. PINZON AND SIMILAR STEAMSHIP—Comparison of Fuel Consumptions at Sea and in Port.

Steamship—

Triple-expansion engines, single screw.
Ship, 270 feet by 38 feet by 18 feet; draft, 17 feet 5 inches.
Voyage, London to Spanish port.
Indicated horsepower, 1,075.
Revolutions per minute, 75.8.
Speed of vessel, 9.35 knots.
Coal used per day, for all purposes, 17.42 tons.
Coal used by auxiliaries per day, 2.5 tons.
Coal used in port per day, discharging and loading, 3 tons.
Banked fires, used per day, 16 days (in average voyage), 1 ton.

Motorship Pinzon—

Diesel engines, single screw.
Ship, 240 feet by 38 feet by 18 feet; draft, 17 feet 6 inches.
Voyage, Glasgow to Spanish ports.
Diesel indicated horsepower, 1,290.
Equivalent steam indicated horsepower, 1,170.
Revolutions per minute, 106.
Speed of vessel, 10.2 knots.
Oil used per day, for all purposes, 4.5 tons.
Oil used by auxiliaries per day, 0.2 ton.
Oil used in port per day, discharging and loading, 0.37 ton.

TABLE IV.—M.S. PINZON. Load in Auxiliary Diesel Generators under Various Conditions

	Nominal Motor Horsepower	Normal Sea Load, Kilowatts		Maneuvering Load, Kilowatts		Load at Starting of Machine, Kilowatts	Port Load, Kilowatts	
		Maximum	Minimum	Maximum	Minimum		Maximum	Minimum
One jacket-cooling pump	6	5.3	5.3	5.3	5.3	...	...	...
One piston-cooling and lubricating oil pump	6	5.3	5.3	5.3	5.3	...	...	...
One bilge pump	8	6.6	6.6	6.6	...	...	6.6	6.6
Lighting	...	3.5	2	3.5	3.5	...	3.5	2
Steering motor	...	5.2	1	5.2	1	...	...	...
Fuel oil pump	1.5	1.45	...	...	...	...	...	...
Ballast pump	22	18.5	...	...	...	...	...	...
Radiators	...	14	3	14	...	...	...	...
Maneuvering motor	4	...	...	3.75	3.75	...	14	...
Auxiliary air compressor	80	...	...	66	28	80	...	...
Windlass	50	...	...	41.6	...	60	...	...
Forward winch starboard	16	...	...	...	...	...	...	...
Forward winch, port	16	...	...	...	...	...	...	...
Middle winch, starboard	16	...	...	...	...	...	14	14
Middle winch, port	16	...	...	...	...	...	...	...
Middle winch, starboard aft	16	...	...	...	...	...	14	...
Middle winch, port aft	16	...	...	...	...	...	...	...
Turning gear	7	...	...	...	...	...	14	...
Total kilowatts	...	59.85	23.2	151.25	46.85	...	72.2	22.6

TABLE V.—M.S. PINZON. Copy of Log of Engine Telegraph Orders carried out on January 13, 1922, entering Delmuir Basin.

P. M.	P. M.	P. M.
Half ahead ... 4.57	Full astern ... 5.53	Slow astern ... 6.6.5
Slow ahead ... 4.59	Stop ... 5.53.1	Stop ... 6.7
Half ahead ... 5.4	Stop ... 5.53.5	Slow ahead ... 6.7.1
Slow ahead ... 5.12	Astern slow ... 5.54	Slow astern ... 6.7.2
Stop ... 5.14	Stop ... 5.54.5	Full astern ... 6.7.5
Slow ahead ... 5.15	Astern slow ... 5.55	Slow astern ... 6.7.5
Half ahead ... 5.26	Stop ... 5.55.5	Stop ... 6.7.6
Slow ahead ... 5.26.5	Slow ahead ... 5.56	Slow ahead ... 6.7.7
Half ahead ... 5.37	Stop ... 5.59	Stop ... 6.8
Slow ahead ... 5.40	Slow astern ... 6.0	Slow astern ... 6.8.5
Stop ... 5.46	Stop ... 6.05	Stop ... 6.8.6
Slow ahead ... 5.47	Slow ahead ... 6.1	Half astern ... 6.9
Stop ... 5.48	Stop ... 6.2	Slow astern ... 6.9.1
Full astern ... 5.48.5	Slow ahead ... 6.4	Stop ... 6.9.2
Slow astern ... 5.50	Stop ... 6.4.5	Slow ahead ... 6.9.5
Ahead slow ... 5.51	Slow ahead ... 6.5	Stop ... 6.10
Full astern ... 5.51.5	Stop ... 6.5.1	Slow ahead ... 6.12
Slow astern ... 5.52	Slow astern ... 6.5.5	Stop ... 6.12.5
Stop ... 5.52.5	Full astern ... 6.6	Finished with en- gines ... 6.15

TABLE VI.—M.S. PINZON. Proceeding to Bilbao from Portugal-ette, February 1, 1922.

A. M.	A. M.	A. M.
Stand by ... 3.5	Slow ahead ... 4.34	Stop ... 5.5
Slow ahead ... 3.20	Stop ... 4.34½	Slow ahead ... 5.6
Full ahead ... 3.28	Slow ahead ... 4.35	Stop ... 5.6½
Slow ahead ... 3.28	Stop ... 4.35½	Slow ahead ... 5.8
Stop ... 3.34	Slow ahead ... 4.36	Stop ... 5.8½
Slow ahead ... 3.35	Stop ... 4.38	Slow ahead ... 5.10
Stop ... 3.35½	Slow ahead ... 4.39	Stop ... 5.11
Slow ahead ... 3.38	Stop ... 4.40	Slow ahead ... 5.12
Stop ... 3.38	Slow ahead ... 4.41	Stop ... 5.13
Slow ahead ... 3.40	Stop ... 4.42	Slow ahead ... 5.15
Stop ... 4.12	Slow ahead ... 4.43	Stop ... 5.15½
Slow ahead ... 4.14	Stop ... 4.44	Slow ahead ... 5.16
Stop ... 4.17	Slow ahead ... 4.45	Stop ... 5.16½
Slow ahead ... 4.18	Stop ... 4.46	Slow ahead ... 5.17
Stop ... 4.18½	Slow ahead ... 4.47	Stop ... 5.18
Slow ahead ... 4.19	Stop ... 4.47½	Slow ahead ... 5.18
Stop ... 4.24	Slow ahead ... 4.47½	Stop ... 5.19
Slow ahead ... 4.25	Stop ... 4.49	Half ahead ... 5.19½
Stop ... 4.26	Slow ahead ... 4.51	Stop ... 5.20
Slow ahead ... 4.28½	Stop ... 4.52	Slow ahead ... 5.21
Stop ... 4.29	Slow ahead ... 4.53	Full ahead ... 5.21½
Slow ahead ... 4.29½	Stop ... 4.54	Stop ... 5.22
Stop ... 4.30½	Slow ahead ... 4.57	Full astern ... 5.26
Slow ahead ... 4.32	Stop ... 4.59	Stop ... 5.26½
Stop ... 4.32	Slow ahead ... 5.1	Half ahead ... 5.27
Stop ... 4.32	Stop ... 5.4	Stop ... 5.27
	Slow ahead ... 5.4½	Finished with en- gines ... 5.44

THE AMERICAN BUREAU OF SHIPPING has under preparation a set of rules to govern the construction of river, harbor and canal craft, with a view of taking up the classification of same.

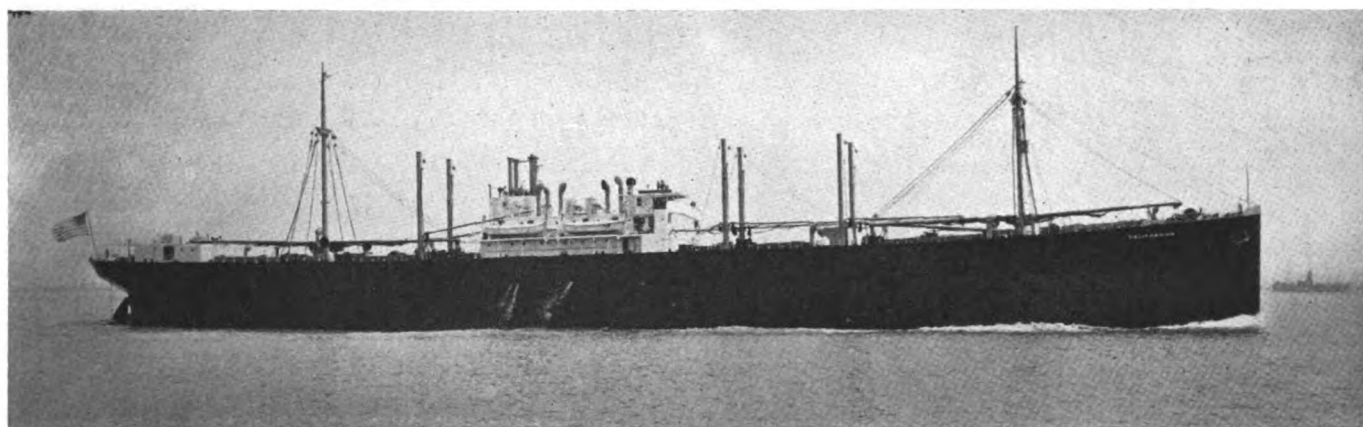
Diesel Electric Ferryboat for Service in San Francisco Harbor

THE *Golden Gate*, which will be the first large automobile ferryboat in this country to be equipped with Diesel engine electric drive, is expected to begin operations in San Francisco Bay early in the coming summer. She will form part of a fleet of ferryboats operated by the Golden Gate Ferry Company, which will offer a fast service between Sausalito and San Francisco, to form a link between the northern and southern highway systems of the State of California.

The *Golden Gate* will have an overall length of 220 feet and a displacement length of about 207 feet. Her propelling equipment will consist of two 500 brake horsepower Werkspoor Pacific Diesel engines each directly connected to a General Electric Company 360 kilowatt, 250 volt, shunt wound direct current generator. The power from these generators will be delivered to two 750 horsepower, 500 volt, 145 to 180 revolutions per minute shunt wound motors, one on each propeller shaft. There will be a 35 kilowatt, 115 volt exciter direct connected to each engine generator and used to furnish power for lights, excitation and engine room and deck auxiliaries.

The boat will represent a radical departure in ferryboat construction, being the first double ended one where each propeller will be driven separately. The most economical method of propelling such a boat is to have the majority of the power concentrated on the propeller that is actually driving it. Electric drive is the only way in which this can be satisfactorily accomplished and still use the same prime mover for both directions of travel eliminating duplicate units for ahead and astern travel.

The flexibility of control which is a feature of Diesel engine electric drive has also been fully taken advantage of in this boat. She will be equipped with Ward Leonard control, with stations in both pilot houses as well as in the engine room.



Motorship Californian of the American-Hawaiian Steamship Company

Sea Trials of the Motorship Californian

Thirteen Knots Speed Attained With Fuel Consumption of 0.31 Pound Per Indicated Horsepower

THE operating records given below, taken during the engine builder's trials of the American-Hawaiian Steamship Company's motorship *Californian* on May 1 and 2, offer an excellent opportunity to study the possibilities of American-built motorships of large size.

A complete description of the *Californian* was given in the February issue of MARINE ENGINEERING AND SHIPPING AGE and only the general details will be repeated here. The vessel was built at the yard of the Merchant Shipbuilding Corporation, Chester, Pa., and all machinery, both main and auxiliaries, at the yard of the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa.

In general, the *Californian* has the following characteristics:

Length, overall	461 feet 7½ inches
Length, between perpendiculars	445 feet
Breadth, molded	59 feet 8 inches
Depth, molded to shelter deck	39 feet
Draft, loaded	28 feet 6 inches
Draft, light	10 feet 7 inches
Block coefficient	0.76

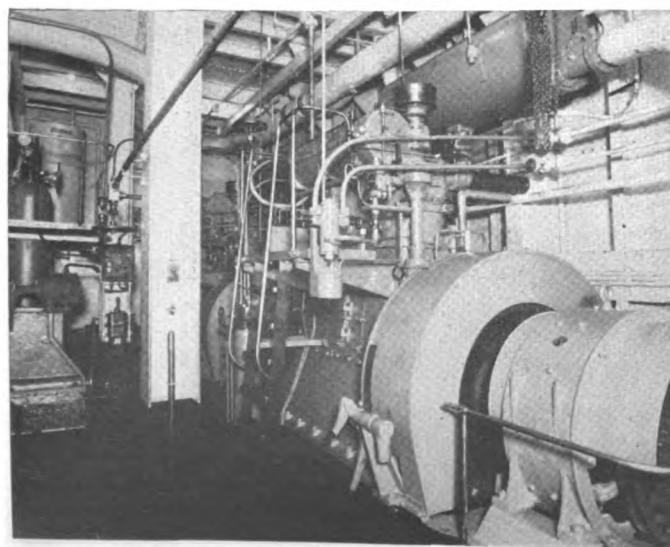
Midship section coefficient	0.986
Longitudinal coefficient	0.77
Speed, loaded, knots	11.5
Cruising radius, nautical miles	25,000
Framing	Transverse
Class	✱ 100 A.I. Lloyd's

The propelling machinery consists of two four-cycle Diesel engines built in accordance with the Burmeister and Wain system, having a total of 4,500 indicated horsepower and a designed speed of 115 revolutions per minute. The auxiliary machinery includes four Diesel engines direct connected to Diehl generators, each operating at a speed of 300 revolutions per minute and delivering 100 brake horsepower.

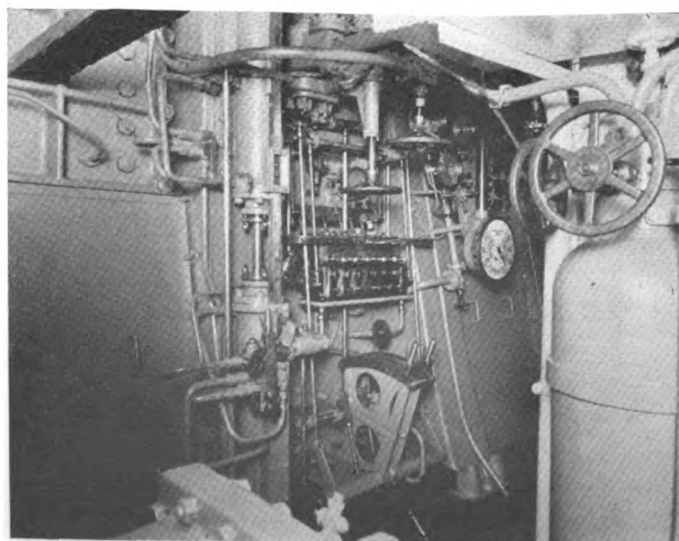
TESTS ON THE MEASURED MILE

An early start was made on the morning of May 1 from the yards of the Cramp Company and, after compass adjustments were made, three runs were carried out over the measured mile course with the following results:

Revolutions per minute, mean	114.62
Mean indicated pressure, main engines	82.8



65-Kilowatt Auxiliary Generator Set



Maneuvering Platform, Port Engine Room

Indicated horsepower, mean, main engines.....	4,330
Speed, knots, corrected for tide	12.57
Slip of propellers	5.4 percent
The maximum speed made over the mile course (uncorrected for tide) was	13.9 knots

On the second day a six-hour continuous run was made, which consisted in running $2\frac{1}{2}$ hours out to sea and back and $3\frac{1}{2}$ hours up the Delaware Bay and river. During this run, the draft of the vessel was 8 feet 3 inches forward and 18 feet aft, thus making the drag so great that the speed of the vessel was sensitive to the depth of the water. For this reason, and because it was necessary to follow the ship channel, the last two hours of the run were not considered in determining the consumption test, the amount of fuel oil used being taken only for the first four hours when the conditions of draft of the vessel were more uniform. In the open sea, the engines turned over at a maximum of 119.25 revolutions per minute without any change in the control of the engine. This engine speed corresponds to slightly over 13 knots. The results of the four-hour consumption test are as follows:

Oil consumption, main engines and one auxiliary engine	1,372 pounds
Indicated horsepower, main engines	4,417
Kilowatt load, auxiliary engine	50
Revolutions per minute, mean, main engines.....	117.58
Corresponding speed from standardization runs....	12.9 knots
Mean indicated pressure, at corresponding speed from standardization runs	82.13
Oil consumption per indicated horsepower, main engines, only (all purposes)	0.31 pound

During the first half hour of the run the consumption was 0.328 pound per indicated horsepower due to the fact that the engines were not yet warmed up and this amount increases slightly the mean consumption for the four hours. For the total six hours the results are indicated below:

Indicated horsepower, main engines	4,445
Revolutions per minute, mean, main engines	117.29
Mean indicated pressure, main engines	82.80

It will be seen from these figures that the mean revolutions per minute are lower and the indicated horsepower higher for the six hours than for the four hours due to the greater resistance to hull in the shallower water, as previously stated, during the latter part of the run.

After the four-hour consumption test was completed the power of the engines was increased slightly to give their normal mean indicated pressure, which is 85.6 pounds, corresponding to the designed indicated horsepower of 4,500 at 115 revolutions per minute with the following results:

Mean indicated pressure, both engines	85.3
Revolutions per minute, mean, both engines	118.26
Indicated horsepower, mean, both engines	4,610

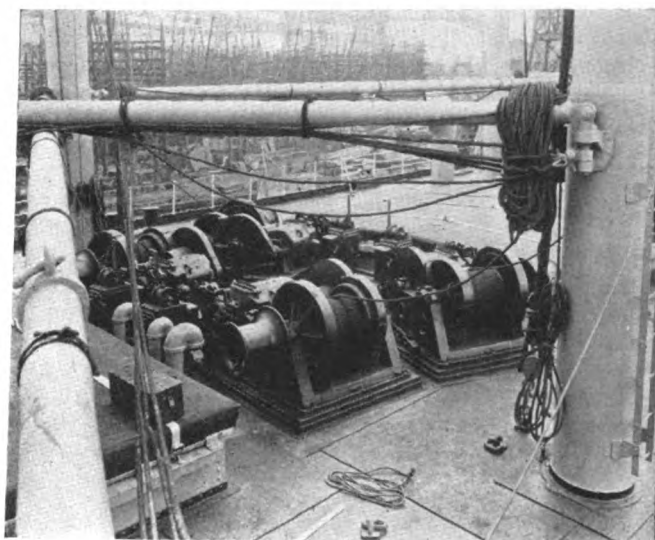
During this run, all inner bottom tanks were filled with oil as well as the peak tanks with water in order to have the screws completely submerged. Under these conditions, the mean draft was 13 feet $1\frac{1}{2}$ inches taken in fresh water or 12 feet 10 inches mean, corrected to salt water, which corresponds to 6,750 tons displacement.

FINAL ADJUSTMENTS MADE TO MACHINERY

After completion of the trials the *Californian* returned to the Cramp Company's yards, where a final examination of the machinery was made and adjustments carried out on the engines. The finishing coat of paint was also put on the engines, since this had been omitted until after the trials.

On May 5 the vessel was taken over by the American-Hawaiian Company and sailed for New York to be dry docked for cleaning and painting of the ship's bottom, which was not done before the trials.

On the run to New York a four-hour consumption test was made with the following results:



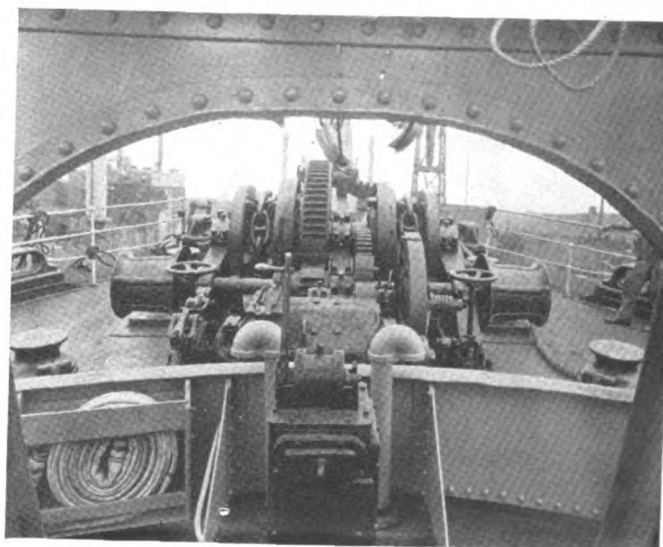
Group of Electric Winches at After Kingposts

	Port Engine	Starboard Engine	Mean
Revolutions per minute....	115.95	116.25	116.10
Mean indicated pressure..	85.65	84.90	
Indicated horsepower	2,267	2,256	4,523
Total gallons			738
Gallons per hour.....			184.5
Pounds of oil per hour...			1,400
Oil per indicated horsepower, main engines, all purposes			0.309

The draft of the vessel on leaving the yard was 7 feet 10 inches forward, 18 feet 5 inches aft, or a mean of 13 feet $4\frac{1}{2}$ inches which, corrected to salt water, was 12 feet 10 inches, the same as on the builder's trials.

All fuel tanks in the inner bottom were completely filled before leaving Philadelphia, there being a total of 9,426 barrels on board. On arrival in New York the draft was 8 feet 1 inch forward and 17 feet 6 inches aft, or a mean of 12 feet $9\frac{1}{2}$ inches. The oil used on this trial was supplied by the Texas Company as it was in the case of the builder's trial, and had the following analysis:

Specific gravity at 60 degrees F.....	0.913
Baumé, corresponding	23.5 degrees
Flash open cup	253
Fire	273
Viscosity Saybolt at 100 degrees F.....	152
Sulphur	0.60 percent
Asphalt insoluble in naphtha.....	1.11 percent
B. T. U.	19,120

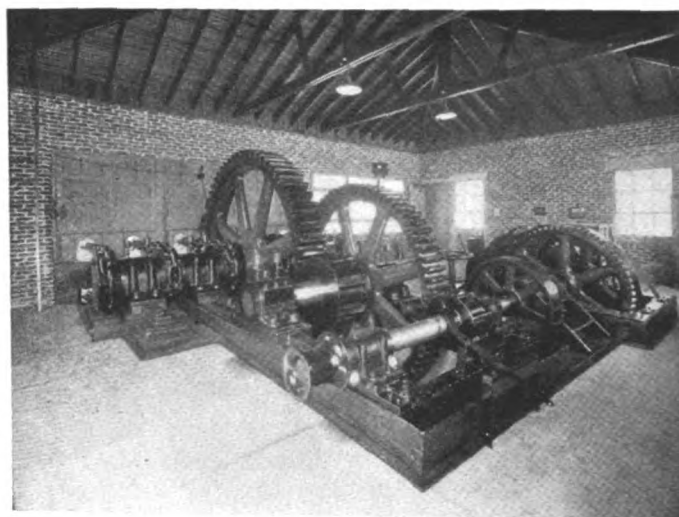


View of the Windlass on the Forecastle

It is interesting to note that the main engines were not run on the test stand in the builder's shops, as is generally the custom with this type of machinery, and the excellent results obtained on the trials justified this omission. The only adjustment required on the engines was in the fuel cam throws, which were quickly made since these were not integral with the fuel cams proper.

With the exception of the fact that there are four auxiliary Diesel generator sets instead of three, the machinery on the *Californian* is practically a duplicate of the motorship *William Penn*. The additional set was necessary because of the larger number of winches employed.

It is expected that the economy of operation will be improved after the ship has been in service for awhile when all bearings and liner surfaces are run in and the finer adjustments made to the fuel control. It is noteworthy that no bearings were raised during the trials nor adjustments made.



Hauling Machinery of 5,000-Ton Railway Dry Dock

5,000-Ton Railway Dry Dock at Norfolk

WITHIN the last year Colonna's Shipyard, Inc., Norfolk, Va., has put into operation a new railway dry dock with a lifting capacity of 5,000 tons weight, making it the largest railway-dry dock on the Atlantic Coast. This dock, which is capable of handling the 10,000-ton deadweight class of ships, has added 40 percent to the dry docking facilities of the port of Norfolk.

The dock was designed and constructed by The Crandall Engineering Company, dry dock engineers, Boston, Mass., according to their standard designs. The track is of the four-way type, of timber construction, heavily bolted and braced, resting on a foundation of yellow pine piling driven to refusal and accurately cut to the correct gradient. The track is railed with flat steel plates. The cradle moves along this track supported on connected free rollers.

The cradle which actually carries the ship is of heavy yellow pine timber construction. The length over the keel blocks is 360 feet, which, with a fantail 20 feet long, gives an over-all length of 380 feet. The width between the over-all is 70 feet with 63 feet in the clear between the uprights. At mean high tide ships can be docked drawing 14 feet forward and 19 feet aft. It is built up aft by columns and heavy bracing so that the keel blocks conform to the usual slope of the ship's keel when in light condition, thus avoiding any distortion or stress to the ships.

On each side of the cradle are uprights supporting a docking platform conveniently located for handling lines and

centering ships when being docked. On this platform are located the hand winches for pulling the bilge blocks against the ship. The bilge blocks are of patent releasing type, enabling one man to readily release and replace a bilge block under full load.

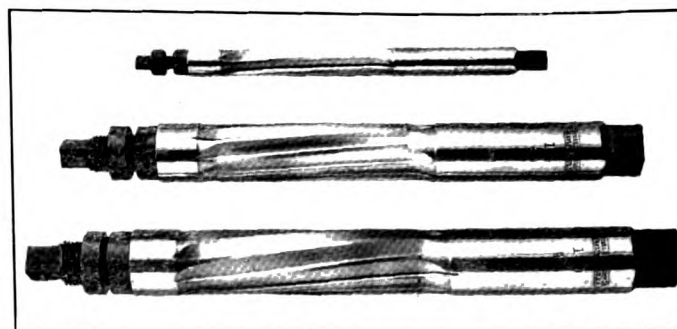
The cradle is operated by six hauling chains of open-link type attached to the cradle by an equalizing gear which assures the stress in the several chains being always the same. These chains are operated by a powerful hoisting machine, electrically operated, enabling a full capacity ship to be dry docked ready for repairs in 45 minutes. The machinery is of special design with heavy gearing and shafts. It is equipped with an automatic brake which stops the machine, in case the electric circuit is broken.

Spiral Fluted Expansion Hand Reamers

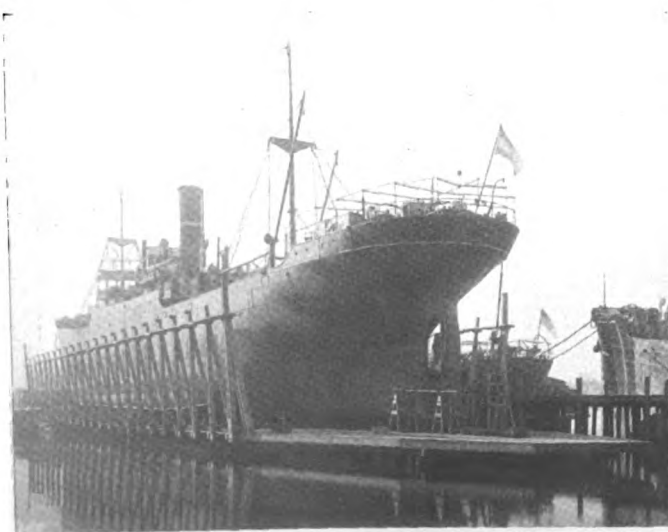
THE Pratt & Whitney Company, Hartford, Conn., has added to its line of small tools a spiral fluted expansion hand reamer. Expansion reamers have always found favor because of their long life and the adjustable feature that permits covering a range of sizes with one tool. Oversize or undersize holes can be reamed by simple adjustments. The advantages of the spiral flute with its free and clean cutting characteristics are obvious.

All reamers are equipped with lock nuts to hold the size and safety stops which prevent over-expansion and indicate positively when the maximum limits have been reached. Three sizes of spiral fluted expansion hand reamers are shown in the illustration, including $\frac{1}{2}$ -inch, 1-inch, and $1\frac{1}{8}$ -inch. These reamers are made in all the regular sizes.

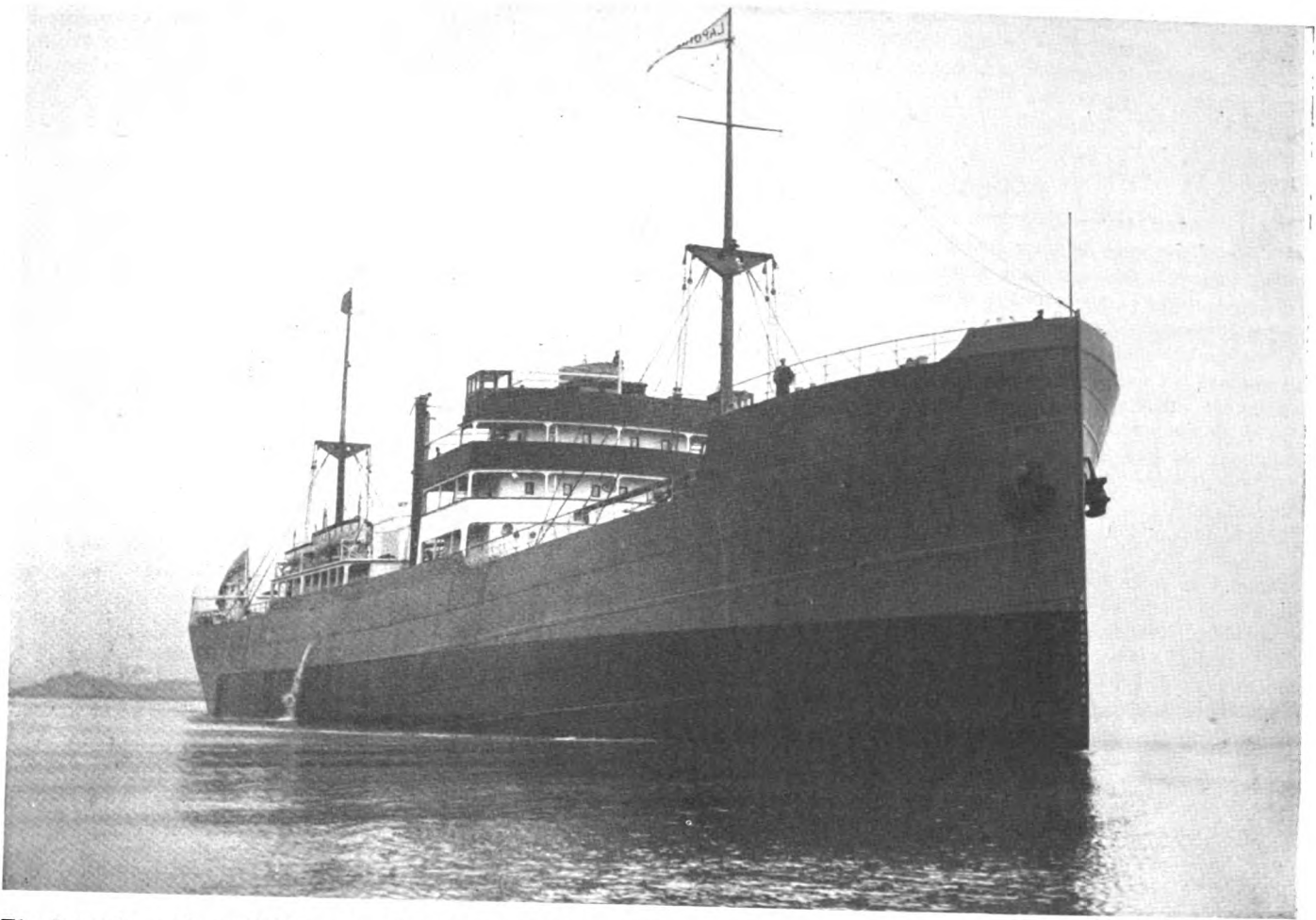
The spiral flutes afford a distinct advantage in reaming holes having keyways in them. The straight flutes catch and bind on the edges, but the spiral continuous shearing cut rides safely over the corners assuring a hole cut to size.



Pratt & Whitney Spiral Fluted Expansion Hand Reamers



S. S. Larenberg on 5,000-Ton Railway Dry Dock at Norfolk



The Laponia, a New 8,200-Ton Ore Carrying Motorship Built by the Gothenburg Shipbuilding Company for the Grangesberg Oxelosund Company. Fourteen Similar Vessels Are On Order

Striking Features of Motorship Building in Europe

Remarkable Doxford Engine Development—More Motor Passenger Liners—Two Versus Four Cycle Diesels—Single Screw Motorships

By Our Special London Correspondent

THE fact that the construction of the Doxford opposed piston oil engine (perhaps the most interesting marine motor now built) is to be taken up at once by the Sun Shipbuilding Company of Chester, Pa., gives added interest in America to the noteworthy developments taking place in connection with this engine. Arrangements have also been made for it to be built at Workman, Clark and Company's Belfast works, and also by the Fairfield Shipbuilding & Engineering Company, on the Clyde.

It will be remembered that two Doxford engined ships have been completed and both of these recently completed their first voyage, that of the *Yngaren* (belonging to the Transatlantic Company) being a 6 months' trip practically round the world, while the first voyage of the *Dominion Miller*, owned by Furness, Withy and Company, was only between British and American ports. In the first engine, the fuel consumption was admittedly somewhat disappointing, working out at about 0.44 pound per brake horsepower hour. As a consequence the Doxford engineers set to work with the object of so modifying the design as to improve combustion and to reduce consumption. The result is that

the engine of the *Dominion Miller*, the second ship, is apparently much more efficient and whereas the fuel consumption of the *Yngaren*, carrying about 9,300 tons at a speed of 11 knots, worked out at 11.6 tons daily, that of the sister ship, at nearly the same speed, was under 10 tons daily.

FUEL CONSUMPTION REDUCED IN THIRD DOXFORD ENGINE

With the third engine that has just been built, and upon which special tests have been made, an even more satisfactory result is achieved and it is stated that fuel consumptions under 0.4 pound per brake horsepower hour are reached, these being quite equivalent to, if not superior to, those attained with four cycle motors.

These low consumptions have been attained by improvements in two directions. In the first place, the spray valves have been modified, and, secondly, the scavenging port system has been altered. By this means the fuel is sprayed in at a pressure of 8,000 to 10,000 pounds per square inch and meets with a volume of air at about 300 pounds per square inch pressure, whirling round with high velocity. Apparently the combustion is as perfect as is obtainable with any Diesel

motor, and it is stated that the exhaust temperature does not exceed 300 degrees. This is with a four cylinder engine of 3,000 indicated horsepower or about 2,700 brake horsepower and Doxfords believe that they have by no means reached the end of their experiments. They are now willing to guarantee six cylinder engines of 6,000 brake horsepower and it may not be long before motors of this size are constructed.

POPULARITY OF SINGLE SCREW SHIPS

One of the most striking features of European motorship development is the increasing number of single screw vessels which are now being placed in commission. It appears that, once shipowners have overcome the idea that motorships are not as reliable as steamers, they prefer to have single screw craft, in spite of the fact that many Diesel engine manufacturers, and in particular Burmeister and Wain, are strong in their contention that a twin screw vessel can be quite as efficient from the propulsive standpoint as a single screw design. Moreover, it appears that large twin screw machinery is probably cheaper and occupies less space than a single screw plant on account of the fact that a single Diesel engine of say 4,000 horsepower is heavier than two sets of 2,000 horsepower. For the same propulsive efficiency a single screw craft must have machinery operating at lower speed than when two engines are fitted and this naturally reacts upon the weight and the cost.

Nevertheless the shipowners' standpoint is that single engines are preferable on account of the smaller cost of upkeep and the fewer attendants required. Hence the great interest now being shown in motor vessels equipped with one engine. So far as reliability is concerned, there appears to be no reason against the single screw ship as instanced by the voyage mentioned above of the *Yngaren* when during six months no troubles of any consequence were experienced. The chief difficulty was in connection with the spray valve which had to be renewed about every four days, resulting in a stop of about one hour's duration in each case.

Among other single screw craft that have just been completed is Beardmore's first oil engined vessel, the *Pinzon*, provided with one of their Tosi type six cylinder Diesel engines of 1,250 brake horsepower. In this design some criticism was aroused on account of the fact that two air compressors were provided on the engine, each of which was capable of supplying all the injection air required. The builders' defense is that it is highly desirable on a single screw vessel to duplicate the injection system but whether shipowners, as a rule, will agree to this extra expense is somewhat doubtful.

Two Werkspoor engined single screw ships were also completed during April, one being the first motor vessel for

the Netherland Steamship Company, the *Rhea*, provided with an 850 brake horsepower engine, and the other the *Segovia*, equipped with North Eastern Werkspoor machinery built by the North Eastern Marine Engineering Company, the leading reciprocating steam engine builders on the Tyne.

TWO CYCLE OR FOUR CYCLE ENGINES

A very heated controversy is now raging through the medium of the engineering and shipbuilding institutions and the technical press in Europe regarding the respective advantages of the two and four cycle types of Diesel machinery. Mr. Blache, the managing director of Burmeister & Wain, is the leading protagonist of the four cycle type and vehemently denies that this is ever likely to be displaced by the two cycle construction. In his opinion the high mean effective pressures claimed by the two cycle engine builders (100 pounds per square inch and upwards) are undesirable in Diesel cylinders and, if shipowners require to work at these pressures, four cycle engine builders would meet the same conditions. He therefore thinks that two cycle engines are rated too high and are unable to maintain their designed output at sea in the same way as is possible with a four cycle engine. Furthermore, he is of opinion that where port scavenging is adopted in two cycle engines—and this is well nigh universal—lubricating oil consumption must be excessive owing to its escape through the exhaust ports and he also objects to the employment of piston rings for a purpose other than that for which they are essentially designed.

The designers of the Sulzer engine retort that the characteristic of working at a high mean effective pressure is one of the peculiar advantages in the two cycle motor and that mean effective pressures exceeding 100 pounds per square inch can be maintained continuously. As a result the two cycle engine can be built more lightly and therefore cheaper than the four cycle design. Furthermore, they claim that, alone with two cycle engines, owing to the absence of exhaust valves, will it be possible to use cheap boiler oil instead of the more expensive Diesel oil. Again, the two cycle advocates aver that the limit has been reached in four cycle engine cylinder output, whereas with two cycle motors there is no reason why engines up to 12,000 brake horsepower in six cylinders should not be constructed.

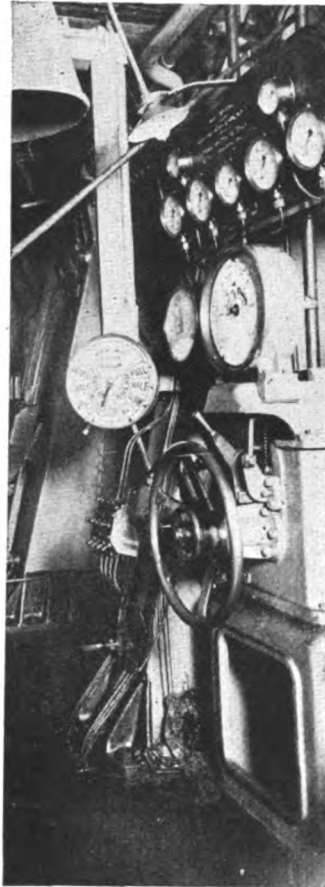
MOTOR PASSENGER LINERS

In spite of the shipbuilding depression, some interesting motor passenger liners are now being built, the largest being an Elder Dempster vessel for trade to West Africa, with accommodation of about 350 passengers.

This ship is over 500 feet in length and is to be provided with twin screw Burmeister & Wain machinery, built by Harland and Wolff, of 6,500 indicated horsepower, giving a speed of $13\frac{1}{2}$ knots. She will, when completed, be the finest motor liner afloat and it is not unlikely that, should the clouds now hanging over the shipping industry lift, further vessels of a similar type will be laid down.

A sister ship to the *Domala*, the first motor liner for the British India Steam Navigation Company, is under construction on the Clyde and will be placed in commission before the end of the year, while the North German Lloyds are about to lay down a 9,000-ton passenger ship for trade between Germany and America. This will be a vessel of the intermediate class with a speed of $12\frac{1}{2}$ -13 knots and in it will be installed four cycle engines of about 6,000 horsepower.

PORTLAND CEMENT SPECIFICATIONS ADVANCED TO AMERICAN STANDARD.—The "Specifications and Tests for Portland Cement," for which the American Society for Testing Materials is sponsor, have been advanced to the full status of "American Standard" by the American Engineering Standards Committee. These specifications were first approved by the A. E. S. C. as "Tentative American Standard" in 1919.

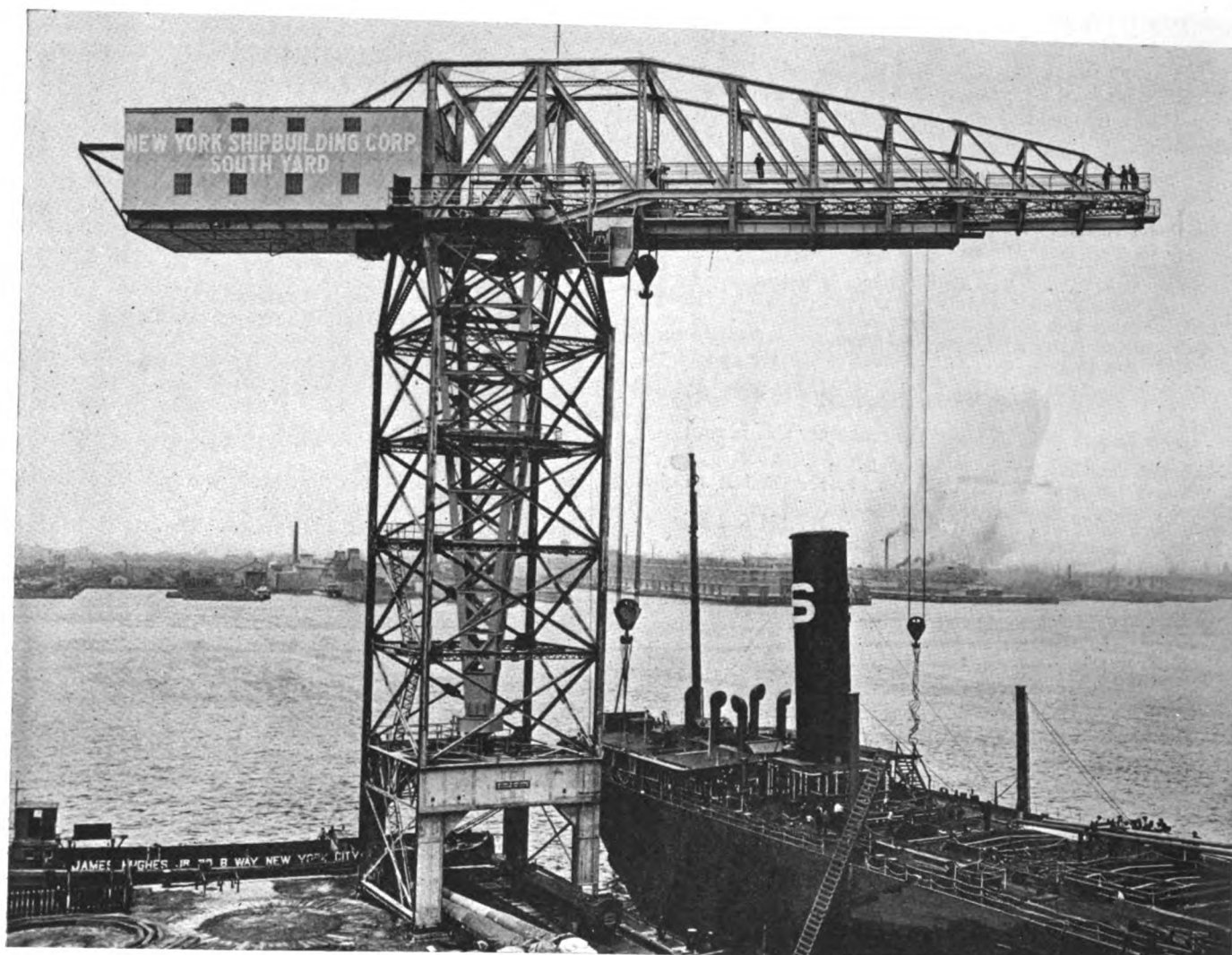


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200-Ton Hammerhead Fitting Out Crane on Pier 7 at the South Yard of the New York Shipbuilding Corporation

Two-Hundred-Ton Fitting Out Crane at Camden Yard

Details of Construction and Operation of Huge Hammerhead Crane Installed at South Yard of New York Shipbuilding Corporation

TO provide for the installation of heavy weights such as boilers, guns, armor, turrets, engines, etc., in ships afloat, the New York Shipbuilding Corporation, Camden, N. J., through its civil engineer, Mr. E. H. Sapp, worked out the basic features of design for a 200-ton hammerhead electrically operated fitting out crane for installation at the head of Pier 7 at its South yard. The detail design and construction of the crane were carried out by the Wellman-Seaver-Morgan Company, of Cleveland, O.

The addition of this crane gives the New York Shipbuilding Corporation the most comprehensive crane system of any industrial plant in the country. Exclusive of the locomotive cranes, the yard is now equipped with 115 cranes well distributed among the shops, storage yards, ways and outfitting piers. They vary in size from those with a capacity of $1\frac{1}{2}$ tons in the joiner shop through the 35-ton gantries on the outfitting piers and the 80-ton overhead traveling crane in the storage yard to the 100-ton overhead crane which serves the main covered unit of five double ways and wet slip, and the new 200-ton hammerhead crane.

The new hammerhead crane consists of a stationary self-supporting tower carrying a vertically rotated mast on the top of which a horizontal boom is securely connected. Normally five distinct motions are provided, viz., main hoist, main hoist trolley travel, auxiliary hoist and auxiliary hoist trolley travel and boom slewing.

The main hoist is made up of two units designed to operate as one unit when lifting the maximum load. The main hoist trolley travel is also made up of two units designed to operate as one unit when handling the maximum load. By removing the main lifting beam that connects the two main lifting blocks and the shifting of two jaw clutches (one connecting each of the two units of the main hoist and the main hoist trolley travel) each hoist unit can be operated independently, allowing the handling of loads up to 200,000 pounds with only one of the units in operation. The shifting of these jaw clutches is accomplished by the operation of hand levers located in the machinery house. Each of the above motions is operated by independent motors controlled from the operator's cab.

The crane has a capacity for handling any load up to 400,000 pounds at a maximum radius of 85 feet and 60,000 pounds at a maximum radius of 125 feet from the center of the tower.

The various motions of the crane have approximately the following speeds:

Main hoist	400,000 pounds at 11 feet per minute
Main hoist (one unit).....	200,000 pounds at 11 feet per minute
Main hoist trolley travel	25 feet per minute
Auxiliary hoist	60,000 pounds at 32 feet per minute
Auxiliary hoist trolley travel.....	100 feet per minute
Slewing motion with either maximum load at each maximum radii or the equivalent, (at 125 foot radius)	125 to 150 feet per minute

PRINCIPAL DIMENSIONS

The principal dimensions of the crane are as follows:

Maximum clear lift from top of foundation (200-ton hooks)	118 feet 0 inches
Maximum clear lift from top of foundation (100-ton hooks)	124 feet 2 inches
Maximum clear lift from top of foundation (30-ton hooks)	126 feet 4 inches
Lowest position of hooks below top of foundation	35 feet 0 inches
Minimum radius of hook from center of tower (main hoist)	30 feet 0 inches
Minimum radius of hook from center of tower (auxiliary hoist)	30 feet 0 inches
Total height of crane over all, about.....	164 feet 0 inches

The boom may be slewed in either direction for an indefinite number of revolutions.

TOWER, BOOM AND MAST

The tower is rectangular and is constructed of rolled steel sections. A portal 22 feet high by 27 feet wide is provided on the two opposite sides of the base. At the top of this tower is a circular track ring in which the vertical mast supporting the boom is centered. This track ring also carries the main circular rack for rotating the boom.

The boom and mast are constructed of rolled steel sections. The forward end of the boom carries the runways fitted with A. S. C. E. section rails, upon which the two main hoist trolleys and auxiliary trolley travel. These runways are arranged with the two main hoist trolleys on the outside and the auxiliary hoist trolley in the center, allowing the auxiliary trolley to pass between.

The boom is extended to the rear of the tower forming a support for the counterweight and machinery house which contains the operating mechanisms. The boom and mast are carried by a heavy thrust bearing framed in the tower just above the main portal. The mast carries horizontal adjustable rollers so located that they roll against the circular T-rail provided on the track ring of the tower, thereby keeping the mast in its vertical position.

MAIN HOIST MECHANISM

This mechanism is made up of two distinct units, each unit being made up of two drums driven by an electric motor through spur gear reductions. These drums are cast iron, machine grooved to receive a single hoisting line. The faces of the drums are sufficient to take the entire line without overwinding the rope. When the hook is in the lowest position there still are two complete wraps remaining on the drum. A jaw clutch controlled by a hand lever in the machinery house provides means for connecting these two units, making them operate as one unit when handling the maximum load.

The main hoist trolley travel mechanism is made up of two separate units, each unit being made up of one drum driven by an electric motor through suitable spur gear reductions. The drums are cast iron, machine grooved to receive two ropes, one winding on as the other pays out. A jaw clutch controlled by a hand lever in the machinery house provides

means for connecting these two units, making them act as one unit when handling the maximum load.

AUXILIARY HOIST

The auxiliary hoist consists of a cast iron drum, machine grooved to receive a single hoist line, driven by an electric motor through spur gear reductions. The face of the drum is sufficient to take the entire line without overwinding the rope. When the hook is in the lowest position there still are two complete wraps remaining on the drum.

MAIN AND AUXILIARY HOIST TROLLEYS

There are two trolleys for the main hoist. Each trolley consists of a structural steel framework carried on four double flanged high carbon steel track wheels. This trolley carries six cast steel sheaves 45 inches in diameter for the hoisting rope.

The hoisting blocks used in connection with these trolleys are of the four sheave type carrying a four pronged forged steel hook arranged to swivel on roller bearings. A structural steel lifting beam is furnished which is suspended from these hooks. This lifting beam in turn carries a four pronged forged steel hook arranged to swivel on a heavy roller bearing.

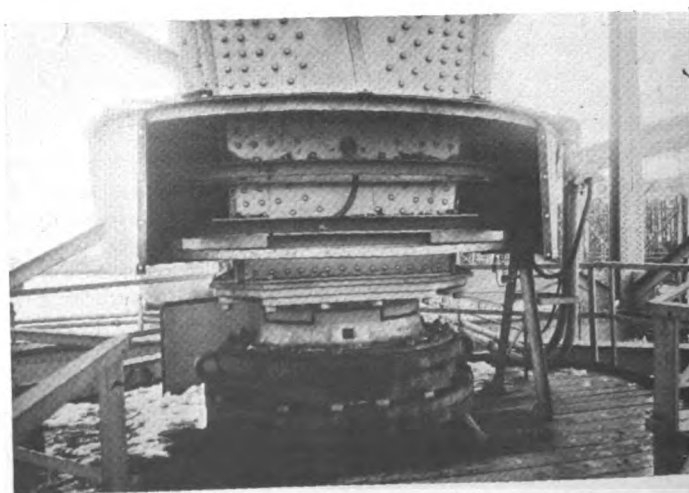
The auxiliary hoist trolley is made up of structural steel, traveling on four double flanged track wheels, and carries three sheaves. The lifting blocks in this case are of the two sheave type, 36 inches in diameter, carrying a four pronged forged steel hook arranged to swivel on a roller bearing.

The hoist and trolley travel ropes are reeved in such a manner as to maintain the hooks at a constant level when racking the trolleys. One and one-half-inch diameter rope is used for the main hoist, 1 1/8-inch diameter for the auxiliary hoist, 1-inch diameter for the main trolley travel, and 5/8-inch diameter for the auxiliary trolley travel.

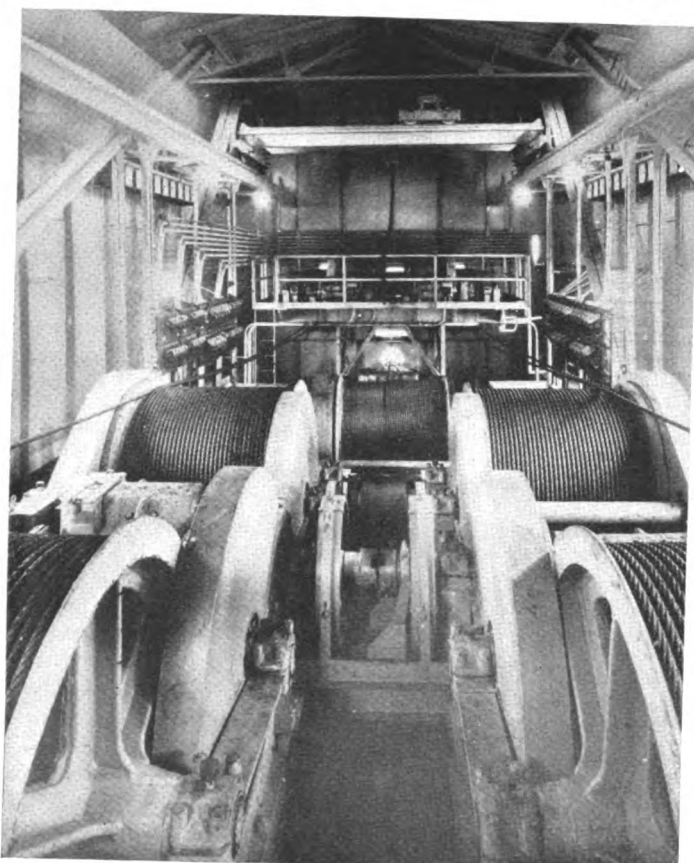
SLEWING MOTION

The mast and boom are rotated by two cast steel pinions meshing with a circular rack secured to the top of the tower. These pinions are driven by an electric motor through spur and bevel gear reductions. The vertical shafts are carried in a cast steel housing secured to the boom. To provide for equal loading on the main driving pinions, a differential unit is inserted in this mechanism.

A powerful foot brake is carried on the intermediate shaft of each hoisting unit, which is of sufficient power and so proportioned that the maximum lifted load may be held or lowered through these brakes in an emergency. The slewing



Step Bearing at Bottom of Vertical Mast, with Cover Over Electrical Conductors Partially Removed



Interior of Machinery House Looking Toward Boom

mechanism is provided with a similar foot brake, which is of sufficient power to hold the boom against a wind load of 10 pounds per square foot and will permit the boom to drift slowly when the wind pressure exceeds 20 pounds per square foot. These brakes are provided with latches, by means of which the brakes may be set and held in any position. The bands are lined with asbestos brake lining.

ELECTRICAL EQUIPMENT

The electrical equipment is designed for a voltage at the machine of 230 volts direct current, and will operate satisfactorily at a slightly higher or lower voltage. All master controllers are located in the operator's cab. Magnetic switch controllers are located in the machinery house, adjacent to the motors.

The motors are of the Westinghouse Electric & Manufacturing Company's make, series wound, mill type, totally enclosed, with fireproof insulation and armature shaft extensions on both ends. The motors are of the following approximate horsepower, based on $\frac{1}{2}$ -hour rating:

Main hoists	2 No. 80 M.C.	110 horsepower
Auxiliary hoist	1 No. 80 M.C.	110 horsepower
Main trolleys	2 No. 40 M.C.	27 horsepower
Auxiliary trolley	1 No. 40 M.C.	27 horsepower
Slewing	1 No. 60 M.C.	65 horsepower

The above motors are equipped with magnetic switch type controllers with drum type master switches, together with the necessary cast grid resistance. Those for the auxiliary and main hoists are arranged for dynamic braking, while those for the main and auxiliary trolleys and slewing are of the plain reversing type.

The main hoist master controllers are so arranged that, if the two main hoists are clutched together and used as a single unit, the master switches can be mechanically connected to operate as a single unit. The same is true of the main trolley master switches.

There is located in the operator's cab a protective panel

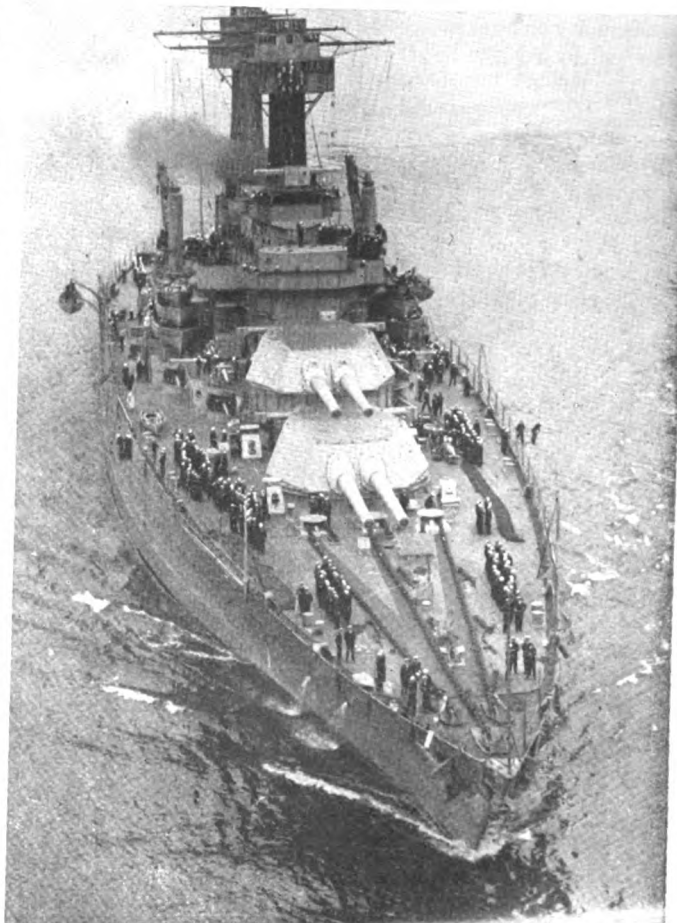
equipped with a main line knife switch which disconnects all apparatus on the crane from the line. This switch is equipped with lock-out clips. Two single-pole circuit breaker contactors, one overload relay in the main circuit, one overload relay in one leg of each motor circuit, and no voltage relay control circuit fuses and a push button for resetting main circuit breakers are mounted on this panel. In this connection there is furnished an emergency switch, located within easy reach of the operator, by means of which he can stop all motions on the crane in case of emergency.

The operator's cab is located on the rotating boom at one side of the tower, giving the operator the best view of his work at all times.

MACHINERY HOUSE

The machinery house is located at the rear of the rotating boom and carries a runway for a hand operated crane. Special doors are provided at the rear of the house, opened and closed from the inside and so arranged that the hand operated crane can travel through them. The runway extends to the rear of the house a sufficient distance to permit of the raising or lowering of any part of the different mechanical units from the ground.

This mammoth crane was shipped by the Wellman-Seaver-Morgan Company in March, 1921, and put in operation at the south yard of the New York Shipbuilding Corporation in the summer of 1921. The total weight of the crane is 825 tons and of the structural material 625 tons.



(Photograph by Kadel & Herbert, N. Y.)

Battleship Maryland, Recently Commissioned Flagship of the Atlantic Fleet

The electrically propelled battleship *Maryland* was built by the Newport News Shipbuilding & Dry Dock Company. The electrical equipment was manufactured by the General Electric Company. The main particulars are: Length, 624 feet; beam, 97 feet 6 inches; draft, 30 feet 6 inches; displacement, 32,600 tons; shaft horsepower, 28,000; speed, 21 knots; main battery, eight 16-inch guns; secondary battery, fourteen 5-inch guns.

The Economic Efficiency of Merchant Ships*

Analytic Methods Show How Effect of Factors Entering Into Final Efficiency Can Be Accurately Assessed and the Results Applied to the Design and Management of Ships

By John Tutin

A MERCHANT ship is primarily designed, constructed and placed on service for the transport of the maximum amount of freight-earning cargo at a minimum of expense, and hence with maximum return to the owner on his outlay. At the same time it must be borne in mind that since there can be no dividend, if the vessel capsizes or a crew cannot be persuaded to man her, the complete test of a merchant vessel should be made on the following lines:

- (1) Profit earning capacity.
- (2) Safety and comfort of crew, and passengers, if any. (Governing factors are: Board of Trade regulations, together with metacentric height, reserve of buoyancy, factor of subdivision, capacity of boats, period of roll, etc.).
- (3) Strength of the structure (as determined by the vessel's classification).
- (4) Resistance to propulsion.

These four divisions are all interdependent and frequently conflicting, the underlying idea in design being to obtain a vessel of such proportions and characteristics as to give maximum potential profits. Divisions 2, 3 and 4 have hitherto received by far the larger share of investigation, as a glance at the list of papers contributed to this institution will show. The profit earning capacity (division 1) measures the economic efficiency as indicated by profit per pound of capital per annum, and has only been approached from the technical standpoint within the last two or three years, Mr. John Anderson, Mr. Alexander Urwin, Messrs. Baker and Kent and Professor Scribanti having contributed important work on this aspect of the question.† The subject, however, has by no means been exhausted.

Let us consider the derivation of an expression for efficiency (E) as indicated by the potential profit. We may write:

$$E = \frac{\text{Freight earnings per annum} - \text{charges per annum}}{\text{Capital invested}} \times 100. \quad (1)$$

This equation is absolute, and no assumptions are necessary. We are in no such happy position when we begin to develop the equation thus:

$$E = \frac{36,500 V [(f-t) C - x T - q k l \Delta^{2/3} L V^2]}{(L + nL \cdot V) P} - 100 y. \quad (2)$$

which is Mr. Baker's formula expressed as a "percent per annum," where

- C = cargo deadweight in tons,
- T = net tonnage,
- Δ = displacement in tons,
- P = first cost in £,
- V = sea speed in nautical miles per day,
- f = freight rate in £ per ton,
- t = sum of brokerage, management, loading, discharge, etc., in £ per ton,
- x = tonnage dues in £ per ton for complete journey,
- l = a factor given by I.H.P. = $l \Delta^{2/3} V^3$,
- q = cost of fuel in £ per ton,
- k = tons of coal per day per I.H.P.,
- y P = sum of insurance, repairs, wages, depreciation in £,
- L = length of voyage in miles,
- nL = number of days in port for loading, discharging, etc.

*Paper read at sixty-third session of the Institution of Naval Architects, London, April, 1922.

†Transactions Institution of Naval Architects, Vols. LX., LXII.; Transactions Northeast Coast Institution of Engineers and Shipbuilders, 1918; Transactions Institution of Engineers and Shipbuilders in Scotland, 1918; Bulletin Technique, 1919-20.

Referring to the formula, we see that:

$(f-t) C$ represents the earnings per voyage in respect of cargo carried.

$x T$ represents the port dues per voyage.

$q k l \Delta^{2/3} L V^2$ measures the cost of the fuel consumed per voyage.

$\frac{365 V}{L + nL V}$ is the number of voyages made in the year.

It will be noticed that the assumption is made that I.H.P. is proportional to $\Delta^{2/3} V^3$. This will only hold approximately for speeds below the limiting economical speed.

Further, C is defined as "cargo deadweight," and will vary therefore with V and L for the same ship, owing to variation in bunker weight. It would be convenient for purposes of differentiation to have C a constant quantity for the same ship. Let us therefore write, assuming a deadweight carrying vessel: $C' = \text{load displacement} - (\text{light weight} + \text{stores})$. A slight error will still be present owing to the fact that stores will vary with V and L. We must now increase the cost of fuel by debiting it with the gross loss in freights due to the carriage of fuel. Further, it would be inaccurate to assume that just sufficient coal is carried to enable the vessel to reach her destination. We must allow a reasonable margin in case of emergency. Let this factor in respect of reserve coal be r (a working value is about $4/3$), and note that normally the additional coal is not necessarily consumed, but is nevertheless carried at the expense of cargo.

Finally, there is the personal element and danger of the vessel not being continuously supplied with cargoes. Let us assume a factor ϕ to cover these and other contingencies. This factor will represent the proportion of her total time during which the vessel is actively employed, and for purposes of comparison may be taken as unity.

Applying these corrections, the formula may now be written:

$$E = \phi \frac{36,500 V [(f-t) C' - x T - (q + rf - rt) k l \Delta^{2/3} L V^2]}{(L + nL V) P} - 100 y. \quad (3)$$

The expression is now in a comparatively general form, and it may be claimed for this process of synthesis that practically every element of variation is accounted for, thus:

L, nL, x represent respectively the effect of route, port facilities and port charges.

k characterizes the type of engines.

l takes account of form $\left(\frac{1}{l} \propto \text{Admiralty coefficient} \right)$.

y is governed by the current rates of wages, etc.

r will indicate roughly the weather conditions prevailing on the particular route and the extent to which the vessel uses her own cargo-handling appliances.

ϕ will take into account the efficiency of the captain and managers, and the state of the freight market.

The important point to notice in this new expression is that the true cost of fuel is now $(q + rf - rt) k l \Delta^{2/3} L V^2$, whence it is clear that the virtual price of fuel is

$$q' = [q + r(f-t)] \text{ per ton} \dots (4)$$

For example, with the nominal price of coal, say, 20 shill-

ings, with a virtual freight rate ($f - t$) of 20 shillings, reserve coal factor $4/3$, the virtual price of fuel works out at $q' = 46$ shillings 8 pence per ton.

A similar expression for virtual price of fuel in a bulk cargo carrier is:

$$q' = q + \frac{r\rho'}{\rho} (f - t) \dots \dots \dots (5)$$

where ρ' is fuel density and ρ is cargo density (in cubic feet per ton).

Where fuel is carried in the double bottom in such a ship the virtual (and nominal) price is simply q .

In connection with equations (3), (4) and (5) the following points should be emphasized:

(1) Cost of fuel is dependent on the reserve coal carried and the freight rate, and hence—

(2) The importance of reducing r as much as possible, consistent with the possibility of a stormy passage.

A mathematical shipowner might get excellent results from the theory of probability in determining the best r for a given voyage.

(3) The value of r for coasting vessels, cross-channel steamers, and smaller craft generally can and should be made larger than for ocean steamers.

(a) Because f is smaller, and hence the relative importance of r is diminished.

(b) Because on a short voyage the probability of rough weather in relation to the number of days at sea is increased.

(4) The virtual price of fuel per ton is in general less for bulk cargo than for deadweight.

When $\frac{\rho'}{\rho}$ is unity the fuel costs are equal, but since coal stows at about 45 cubic feet per ton, and the limiting density for "bulk" cargo, $\frac{\rho'}{\rho}$, may be taken at about 55, we see that for the same virtual freight rate the virtual price of fuel is materially less.

(5) Note from equation (3) that total fuel consumption on a given voyage is proportional to V^2 , and that, given a vessel with bunker capacity for L miles at V knots, her trading radius can be very considerably increased by reducing V to some smaller speed, say v .

The radius is in fact increased in the ratio $\left(\frac{V}{v}\right)$, and this without materially affecting profits (see later).

When cargoes are scarce this fact would appear to be of some importance, since it means greater scope for a vessel with restricted bunker capacity; but the use which could be made of this would depend of course on the flexibility of the main engines.

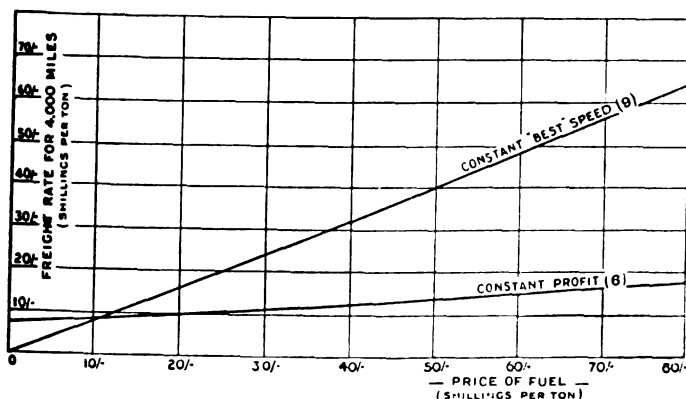


Fig. 1

These curves are drawn for assumed initial conditions:

$$f_0 = 10s.; \quad q_0 = 12s. 6d.$$

and represent approximate values of freight rate and fuel price in order that—

(a) The "best" speed, which was initially the actual service speed, should remain constant.

(b) The initial efficiency or profit should remain constant.

N. B.—The ratio F/C required for curve (b) is taken for a 410-foot vessel (see Appendix).

Referring back to equation (3), we note that for a given ship designed for and trading on a given route, initially under external conditions specified by

$$f_0, q_0, \phi, x, y,$$

and making the reasonable assumption that changes in these quantities are confined to f_0 and q_0 , the freight rate and fuel price, we can derive an instructive relation between these two factors if the owner's initial profit is to be maintained. Clearly this condition is expressed by:

$$fC' - (q + rf)kl\Delta^{2/3}V^2L = \text{a constant } K$$

And since $(kl\Delta^{2/3}V^2L) = F$, the fuel consumption in tons for the voyage, also K being determined by the initial values f_0, q_0 , we obtain the result:

$$\frac{f - f_0}{q - q_0} = \frac{F}{C} \dots \dots \dots (6)$$

where $C = C' - rF = \text{net cargo capacity}$.

We deduce from this that if the initial profit is to be maintained, a curve of freight rate on a base of fuel price (Fig. 1) must be a straight line (for the given voyage), or, in other words, the ratio of increase in freight rate ($f - f_0$) to

increase in fuel price ($q - q_0$) should be constant $\left(= \frac{F}{C}\right)$

Now the question naturally arises, what speed, i.e., what value of V for a given vessel, will make E a maximum? But before differentiating let us investigate any assumptions which would be implicit to that operation—clearly they are that all quantities other than V are constant.

We note that we have made C' constant, or nearly so, the slight variation of C' with speed owing to reduced stores, etc., as V is increased being offset by the increase in machinery weight, unless indeed we premise machinery of such flexibility that it can cope efficiently with wide variations of power.

Further, although displacement Δ at the beginning of a voyage may be assumed constant, yet owing to the fact that total fuel consumption on the voyage will vary as V^2 , the displacement at the end of voyage will be by no means constant; in other words, the higher the speed the less the final displacement will be. Thus, as V is increased the mean value of Δ for the voyage is reduced. The effect will be to increase somewhat the calculated best speed, and the increase on the theoretical result will be greater the longer the voyage.

Differentiating now with respect to V , and equating the result to zero, we arrive at the result:

$$q'kl\Delta^{2/3}V^3B\left(\frac{3L}{VB} + 2nL\right) = (f'C' - xT) \dots \dots (7)$$

which gives the best speed, V_B , in terms of quantities which can be measured, calculated, or assumed for a given vessel (for working, see Appendix). We note that the best speed is not affected by wages y and capital P , nor by the "activity factor" ϕ , while it is dependent on all the other quantities in the expression for E .

A simpler equation for V_B can be derived thus:

Let the estimated "virtual" cost of coal for the whole voyage at a given speed, V_0 , be $q'kl\Delta^{2/3}V_0^2L = M_0$.

Then the best speed is given by:

$$\frac{M_0V^3}{LV_0^2}\left(\frac{3L}{VB} + 2nL\right) = (f'C' - xT) \dots \dots (8)$$

In practice the best method of determining the best speed for a proposed vessel of deadweight C' (ex stores), and for given conditions of the shipping industry, is to construct an Efficiency-Speed curve based on equation (3). Such a curve can be of considerable guidance in the choice of a suitable speed. A specimen curve is shown (Fig. 2) for a 410-foot vessel.

The designed speed should approximate to as closely as possible, without exceeding, the "best" speed under the prevailing conditions. Before the best speed is reached there is quite a wide range of almost equally profitable speeds, whereas when the best speed is exceeded returns will very rapidly diminish. Conservatism with regard to designed speed cannot be too highly recommended, since, if freight rates fall more rapidly than the price of fuel, the designed speed may actually become the best speed while a similar but faster vessel is running at a loss. Similarly, if there is a spurt in freights, the vessel while maintaining her designed speed will still be able to run at an efficiency only slightly less than her sister vessel.

Summarizing results so far, we have obtained an expression for E and have shown how freight rate should vary, with fuel price, if a given ship is to maintain her initial E .

We have also obtained an expression for the best speed for a given ship under given initial conditions. How should freight rate vary with fuel price, if this best speed is to remain constant? It is obvious that a given speed might be the "best" speed over quite large variations in freight rate provided fuel can be obtained at corresponding prices.

Referring to equation (7), the condition for constant V_B can be written:

$$\frac{\partial V_B}{\partial f} \delta f + \frac{\partial V_B}{\partial q} \delta q = 0$$

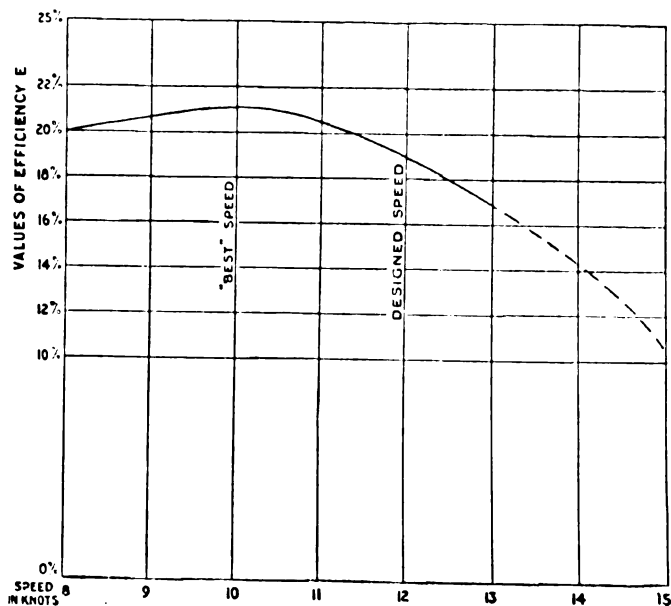


Fig. 2.—Efficiency-Speed Curve for a 410-Foot Vessel (For Details, See Appendix)

Length of voyage, 4,000 miles }
(f) Freight rate, 10s. }
(q) Price of coal, 12s. 6d. }

The curve will be substantially the same for all values of f and q given by the formula:

$$\frac{f - f_0}{q - q_0} = \frac{f_0}{q_0}$$

i. e. $\frac{f - 10s.}{q - 12s. 6d.} = 0.8$

A direct calculation of the "best" speed under the same conditions, by formula (8), gave $V_B = 10.01$ knots. i. e. the change in V_B due to changes δf and δq in f and q is zero; and on differentiating (see Appendix):

$$\frac{\delta f}{\delta q} = \frac{f_0}{q_0}$$

(neglecting for our present purposes the effect of tonnage dues). A first approximation to the required relation is thus seen to be:

$$\frac{f - f_0}{q - q_0} = \frac{f_0}{q_0} \quad (\text{for constant "best" speed}) \dots (9)$$

But an earlier formula gave:

$$\frac{f - f_0}{q - q_0} = \frac{F}{C} \quad (\text{for constant } E) \dots (6)$$

In these formulæ, f_0, q_0 are initial and f, q are subsequent values of freight rate and fuel price, while F/C is the

Total fuel
ratio $\frac{\text{Total fuel}}{\text{Cargo}}$.

An inspection of these formulæ reveals the fact that for a given increase in the cost of fuel, the increase in freight rate necessary to maintain the owner's profit is small compared with the increase which would be necessary in order that the normal service speed still remains the "best" speed. Since the normal tendency of the freight market will be to grant the shipowner more or less steady profits as indicated by equation (6) rather than (9), the necessity for a conservative designed speed becomes even more marked.

We may now proceed to the analysis of the efficiency formula and the determination of the influence which the various factors such as speed, displacement, tonnage, freight rate, length of voyage, etc., have on the final profit. In other words, we wish to measure the relative importance of these various factors in order that in a particular case we may see which factor or factors should receive most attention with view to maximum profits. Concentration on a factor in proportion to its relative importance should both in theory and in practice give improved results.

With this end in view, let us define "relative importance" of a given factor as "the percent change in the value of the expression for 1 percent change in the factor."

Thus, if $E = f(x_1, x_2, x_3 \dots x_n \dots)$, where f denotes "function of," then the relative importance of x_n is given by $\frac{\delta E}{E} \times 100$ for $\delta x_n = \frac{x}{100}$, and since $\delta E = \frac{\partial E}{\partial x_n} \delta x_n$, we have:

$$\text{R.I. of } x_n = \frac{\partial E}{\partial x_n} \cdot \frac{x_n}{E}$$

This method can be applied directly to the general expression for E [equation (3)], whence a formula for the relative importance of each factor can be derived. These formulæ and the corresponding numerical results for a 410-foot steamer are given in the Appendix. Having determined the relative importance of the factors in the final efficiency of the ship, quite a wide range of usefulness is opened out, since we may now

(1) Assess with a reasonable degree of accuracy the part each factor plays in the final efficiency, in relation to the other factors. From the sign (+ or -) of the relative importance we see whether the factor is "for" or "against"—whether efforts should be made to increase it or reduce it.

(2) Determine the resulting change in efficiency likely to accrue from any proposed changes in any factor or factors.

(3) In particular we can estimate closely whether ideas involving increased capital cost, and/or loss of deadweight, are worth adopting under current conditions.

If, for instance, the naval architect is considering the merits of a patent cargo-handling system, for which certain advantages over the normal type are claimed, he could make a rough estimate (see table on page 389).

(4) We can compare the merits of different voyages, routes or trades in a similar way, taking into account the freight rate offered, fuel costs at each end, port dues, etc.

(5) We can compare the efficiencies of two ships. Since E is so largely dependent on external factors, it is desirable that there should be some easily applied "test" of ships which is independent of these factors. By adopting a ratio method as indicated in the Appendix, a useful means of comparison is obtained.

Referring to the relative importance formulæ and numerical results given in the Appendix, it will be noticed that

while the formulæ given are only for the factors definitely entering into the efficiency formula, yet by means of the theorems enunciated in the Appendix the formula for almost any conceivable subsidiary factor can be derived. It must be borne in mind that theoretically a relative importance number only holds over a small range of variation in values owing to its being based on a partial differential coefficient. In almost all cases, however, except in that of speed, a reasonable degree of freedom may be taken in practice. The following notes on the Appendix results may be found useful.

Speed (1).—The relative importance of V is necessarily zero at the "best" speed, since $\frac{\partial E}{\partial V} = 0$, and above the best

speed is negative and increases very rapidly. Below the best speed it is positive, but increases more slowly. See the $E-V$ curve, Fig. 2.

Displacement (2).—This formula refers to changes of draft only, with consequent reduction in the weight of fuel consumed.

Estimated Effect on Factors		Relative Im- portance	(Product) Percent Increase in E	(Product) Percent Decrease in E
Factor	Percent			
Time in port.....	—10	—0.573	5.73	—
Cargo handling expenses.....	—10	—1.4	14.00	—
First cost.....	—5	—1.733	—	8.66
Deadweight capacity.....	—5	3.03	—	15.15
Total.....	—	—	19.73	23.81

First Cost (3), Activity (4), and Number of Voyages per Annum (21).—Necessarily of equal importance. First cost negative, ϕ and N positive.

Size (5).—The assumption is made that the size of the vessel is increased with proportional increases in Δ , P , T , C . An interesting result is obtained, namely, that unless the vessel is being run at a loss increase of size will always mean increased efficiency, since when E is positive the relative importance of size is always positive. Since l diminishes with increase of size this effect is actually more pronounced.

M. Bertin (Assoc. Tech. Mar., 1913) shows, however, that there is a definite limit to increase of size, from structural considerations.

Deadweight (11).—As might have been anticipated, this is the most important factor. For example, under normal external conditions (A), a change of 1 percent in deadweight produced a change of no less than 3 percent in the efficiency. This illustrates the value of any means for reducing hull, machinery, equipment or fuel weights.

Freight Rate (8).—It might at first be thought that this should be of the same importance as deadweight, but f also occurs in the expression for the cost of fuel, and hence its importance is somewhat diminished.

Tonnage (12) and Tonnage Dues (16).—Necessarily of equal importance, and yet, judging by the numerical result, this importance is sometimes over-estimated.

Total Coal, Fuel Consumption and Form (13).—This result is interesting, since it shows that engine design and form are of equal importance; to be more precise, one may split up the factors l and k thus:

$$l = \frac{\text{I.H.P.}}{\Delta^{2/3} V^3} \text{ where } V = \text{miles per day.}$$

$$\text{i.e. } \frac{1}{l} \propto \frac{\Delta^{2/3} V^3}{\text{E.H.P.}} \times \frac{\text{E.H.P.}}{\text{S.H.P.}} \times \frac{\text{S.H.P.}}{\text{I.H.P.}}$$

where

$$\frac{\Delta^{2/3} V^3}{\text{E.H.P.}} \text{ measures "form" efficiency}$$

and

$$\frac{\text{E.H.P.}}{\text{S.H.P.}} = \text{propeller efficiency}$$

$$= (\text{screw efficiency in open}) \times (\text{hull efficiency}) \times (\text{relative rotative efficiency})^*$$

and

$$\frac{\text{S.H.P.}}{\text{I.H.P.}} = \text{engine efficiency.}$$

Also

$$\frac{1}{k} \propto (\text{calorific value of fuel}) \times (\text{thermal efficiency of engines}),$$

and hence the product kl is made up of the following component factors, each of equal numerical importance to k and l but of opposite sign (+):

$$\frac{1}{kl} \propto \begin{aligned} &\text{calorific value of fuel} \dots\dots\dots (a) \\ &\times \text{thermal efficiency of engines} \dots\dots\dots (b) \\ &\times \text{mechanical efficiency of engines} \dots\dots\dots (c) \\ &\times \text{efficiency of thrust block and bearings} \dots\dots\dots (d) \\ &\times \text{screw efficiency in open} \dots\dots\dots (e) \\ &\times \text{relative rotative efficiency} \dots\dots\dots (f) \\ &\times \text{hull efficiency} \dots\dots\dots (g) \\ &\times \text{form efficiency} \dots\dots\dots (h) \end{aligned}$$

The factors giving most scope for improvement would appear to be (a) (adopting liquid fuel); (b) (Diesel engines in place of steam); (d) (single collar thrust block); (e) (increased attention to propeller design).

In actual design it must be remembered that the factors which will best repay concentrated efforts towards improvement are those which afford the most scope for variation in association with their relative importance values; and in conclusion I submit that only by a study of the individual effect which each factor or group of factors has on the final efficiency can one hope to obtain clear ideas on what to make for in ship design.

APPENDIX I

RELATIVE IMPORTANCE FORMULÆ

General expression for efficiency:

$$E = \frac{\phi 36,500 V [f' C' - x T - q' k l \Delta^{2/3} V^2 L]}{(L + nL V) P} - 100 y$$

NOTE.

$$f' = (f - t) = \text{Virtual freight rate.}$$

$$q' = (q + r f - r t) = \text{Virtual fuel price.}$$

$$k l \Delta^{2/3} V^2 L = F = \text{Total fuel consumption.}$$

1. **Speed.**

$$\frac{\partial E}{\partial V} \cdot \frac{V}{E} = \frac{V}{E} \cdot \frac{36,500 \phi}{F} \left\{ \frac{f' C' L - L x T - q' F (3 L + 2 V nL)}{(nL V + L)^2} \right\}$$

2. **Displacement (for changes of draft only).**

$$\frac{\partial E}{\partial \Delta} \cdot \frac{\Delta}{E} = \frac{-\Delta}{E} \cdot \frac{\phi}{P} \cdot \frac{36,500 V}{L + nL V} (2/3 q' k l \Delta^{-1/3} V^2 L)$$

3. **First Cost.**

$$\frac{\partial E}{\partial P} \cdot \frac{P}{E} = - \left(1 + \frac{100 y}{E} \right)$$

4. **"Activity."**

$$\frac{\partial E}{\partial \phi} \cdot \frac{\phi}{E} = + \left(1 + \frac{100 y}{E} \right)$$

5. **Displacement (for changes of size with proportional changes in Δ , P , T , C').**

$$\frac{\partial E}{\partial \Delta} \cdot \frac{\Delta}{E} = \frac{\Delta}{E} \cdot \frac{36,500 V \phi}{nL V + L} \cdot \frac{1}{3} \frac{\Delta^{-1/3}}{a_3} q' k l L V^2 \left\{ \begin{aligned} &C' = a_1 \frac{\Delta}{\Delta} \\ &T = a_2 \frac{\Delta}{\Delta} \\ &P = a_3 \frac{\Delta}{\Delta} \end{aligned} \right.$$

6. **Time in Port.**

$$\frac{\partial E}{\partial nL} \cdot \frac{nL}{E} = \frac{-nL}{E} \cdot \frac{36,500 V \phi}{P} [f' C' - x T - q' F] \frac{V}{(nL V + L)^2}$$

7. **Wages, Depreciation, etc.**

$$\frac{\partial E}{\partial y} \cdot \frac{y}{E} = \frac{-100 y}{E}$$

8. **Freight Rate.**

$$\frac{\partial E}{\partial f} \cdot \frac{f}{E} = \frac{f}{E} \cdot \frac{36,500 V \phi}{(nL V + L) P} (C' - r F)$$

9. **Length of Voyage.**

$$\frac{\partial E}{\partial L} \cdot \frac{L}{E} = \frac{L}{E} \cdot \frac{36,500 V \phi}{P} \left\{ \frac{q' F}{L} + (f' C' - x T - q' F) \right\} \frac{V}{(nL V + L)^2}$$

*See G. S. Baker, *Ship Form, Resistance and Screw Propulsion*, page 170.

10. Fuel Price.

$$\frac{\partial E}{\partial q} \cdot \frac{q}{E} = -\frac{q}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P} \cdot F$$

11. Deadweight.

$$\frac{\partial E}{\partial C'} \cdot \frac{C'}{E} = \frac{C'}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P} \cdot f'$$

12. Tonnage (Net).

$$\frac{\partial E}{\partial T} \cdot \frac{T}{E} = -\frac{T}{E} \cdot \frac{36,500 V \phi}{(L + \pi L V) P} \cdot x$$

13. Fuel Consumption (per I.H.P.-hour).

$$\frac{\partial E}{\partial k} \cdot \frac{k}{E} = -\frac{k}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P} \cdot \frac{q' F}{k}$$

14. Admiralty Coefficient.

$$\frac{\partial E}{\partial l} \cdot \frac{l}{E} = \frac{l}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P} \cdot \frac{q' F}{l}$$

15. Reserve Coal.

$$\frac{\partial E}{\partial r} \cdot \frac{r}{E} = -\frac{r}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P} \cdot f' F$$

16. Tonnage Dues.

$$\frac{\partial E}{\partial x} \cdot \frac{x}{E} = \frac{x}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P} \cdot T$$

17. Total Freight Earnings.

$$\frac{\partial E}{\partial (f' C')} \cdot \frac{f' C'}{E} = \frac{f' C'}{E} \cdot \frac{36,500 V \phi}{(L + \pi L V) P}$$

18. Total Tonnage Dues.

$$\frac{\partial E}{\partial (x T)} \cdot \frac{x T}{E} = -\frac{x T}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P}$$

19. Total Fuel Costs.

$$\frac{\partial E}{\partial (q' F)} \cdot \frac{q' F}{E} = -\frac{q' F}{E} \cdot \frac{36,500 V \phi}{(\pi L V + L) P}$$

20. Number of Voyages per Annum.

$$\frac{\partial E}{\partial N} \cdot \frac{N}{E} = \left(1 + \frac{100 y}{E}\right)$$

21. Length of Voyage (with proportional variations in freight rate).

$$\frac{\partial E}{\partial L} \cdot \frac{L}{E} = I_L + I_f \left(\begin{matrix} I_L = \text{R.I. of } L, f \text{ constant} \\ I_f = \text{R.I. of } f, L \text{ constant} \end{matrix} \right)$$

Theorem 1.—If x_n is a term in an expression (E) and of relative importance a , and z_n is a term in the expression x_n and of relative importance therein β , then the relative importance (ρ) of z_n in the expression E is given by:

$$\rho = a \beta$$

Theorem 2.—If x_n, x_m are terms in an expression (E) and of relative importance a, a_1 , and z_n is a term in both x_n, x_m and of relative importance therein β, β_1 , then the relative importance (ρ_1) of z_n in the expression is given by:

$$\rho_1 = a \beta + a_1 \beta_1$$

NUMERICAL RESULTS.

The vessel considered is the third vessel in Mr. Anderson's series of five. Calculations for this vessel have also been made by Mr. Baker ("Best" Speed) and by Professor Scribanti (Depreciation), in addition to Mr. Anderson.

Deadweight	8,260 tons	Length of voyage (L) ..	4,000 miles
Deadweight (C')	8,110 tons	Freight rate (f)	10s per ton
Displacement (Δ)	11,520 tons	Cargo handling (t)	3s. 6d. per ton
Net tonnage (T)	3,120 tons	Tonnage dues (x)	1s. 3d. per ton
Sea speed (V)	288 miles/day	Price of coal (q)	12s. 6d. per ton
Time in port (πL)	6.8 days	Wages depreciation (yP) ..	1/7 P
First cost (P)	66,800 pounds	"Activity" (φ)	0.85
Total coal consumed (F) ..	901 tons	Total coal carried (rF) ..	1,081 tons (r = 1.2)

Relative importance factors are worked out for the following three sets of conditions:

$f = 10s.$ $q = 12s. 6d.$ $E = 19.5 \text{ percent}$	A. Approximately "normal" relations between f and q . The designed speed (12 knots) is, however, somewhat in excess of the "best" speed, but in view of the mean displacement effect the difference is not so great as it would seem.
$f = 23s. 6d.$ $q = 12s. 6d.$ $E = 126 \text{ percent}$	B. Abnormally high freight rate in relation to the fuel prices. Twelve knots is very nearly the "best" speed.
$f = 10s.$ $q = 20s.$ $E = 12.2 \text{ percent}$	C. Abnormally low freight rate, the vessel is now running at a most uneconomical speed. Since under these conditions φ is probably much less than 0.85, the ship will presumably be laid up.

Formula	Relative Importance Factors		
	A	B	C
11 Deadweight	+3.03	+1.44	+4.85
8 Freight rate	+2.62	+1.24	+4.22
3 First cost	-1.73	-1.11	-1.17
4 Activity	+1.73	+1.11	+1.17
— Cargo handling costs ..	-1.43	-0.221	-2.29
— Total coal consumption ..	-1.05	-0.291	-2.36
13 Form	-1.05	-0.291	-2.30
13 Fuel per I.H.P.-hour	-1.05	-0.291	-2.30

Relative Importance Factors

Formula	A	B	C
7 Wages, etc.	-0.733	-0.113	-1.18
2 Displacement	-0.700	-0.194	-1.54
10 Price of fuel	-0.647	-0.103	-1.67
6 Time in port	-0.573	-0.364	-0.714
15 Reserve coal	-0.403	-0.191	-0.645
5 Size of vessel	+0.354	+0.098	+0.775
1 Speed	-0.313	+0.053	-1.036
12 Tonnage	-0.23	-0.035	-0.368
16 Tonnage dues	-0.23	-0.035	-0.368
9 Length of voyage	-0.22	-0.103	-0.375

EFFICIENCY 19.5 perc't. 126.7 percent 12.2 p.ct.

"BEST" SPEED (KNOTS)..... 10.01 13.2 8.0

The relative importance results may be assumed to hold approximately for any other values of f and q which are in proportion to the above, as per formula (6).

The variation in the order of magnitude under different external conditions shows that the details of design which should receive most attention will vary with the prevailing conditions of shipping.

RATIO METHOD

The merits of two ships can be compared as below, the advantage of the method being that while it is based on the results of the E formula, it is more readily performed, and at the same time a weak point in the vessel's efficiency can be at once detected; the relative importance values should, of course, be normal.

Ratio (Constant D.W. Denominator)	Values of Ratio		Percent Differ- ence from "Standard"	Relative Im- portance Factor	Effective Differences	
	"Stand- ard" or Basis Vessel	"Test" Vessel			+	-
First cost						
Deadweight				First cost		
Estimated fuel*						
Deadweight				Total fuel		
Net tonnage						
Deadweight				Tonnage		
Number of crew						
Deadweight				Say, 2/3 R.I. of y		
Rate of discharge, tons						
Deadweight				Time in port		
Ton-miles per hour†				Voyages per annum‡		
Deadweight						

*For a standard length of voyage at the design speed.

†This ratio equals speed in knots.

‡This factor estimates the influence of speed on the rate of earning profits without reference to its effect on fuel bill.

N. B.—Other ratios can be introduced:	Machinery weight	Hull weight
Water ballast	Deadweight	Deadweight
Deadweight		

DERIVATION OF FORMULA (2)

1. Developing formula (1) we have:

$$E = \frac{\text{Earnings per voyage} - \text{Charges per voyage}}{\text{Capital}} \times \text{Number of voyages} \times 100$$

Earnings per voyage can be written as $(f - t) C$.

Charges per voyage may be split up thus:

(a) Tonnage dues: $x T$.

(b) Fuel cost: q (weight of fuel consumed) $= k l \Delta^{2/3} V^3 \times \frac{L}{V}$

(c) Annual charges: Wages, depreciation, etc., totalling $y P$, and as a percentage of P : $100 y$.

$$\text{Number of voyages} = \frac{365}{\text{Number of days for complete voyage}} = \frac{365}{\pi L V + L}$$

where $\pi L V$ = time at sea, πL = time in port.

But

$$\pi L = \frac{L}{V}, (\pi L V + L) = \frac{\pi L V + L}{V}$$

$$\therefore \text{number of voyages} = \frac{365 V}{\pi L V + L}$$

and thus formula (2) is derived as:

$$E = \frac{365 V}{\pi L V + L} [(f - t) C - x T - q k l \Delta^{2/3} V^2 L] \times \frac{100}{P} - 100 y$$

2. The fuel of total weight $r k l \Delta^{2/3} V^2 L$ is carried at the expense of cargo, and thus the loss in freight earnings is $(f - t) r k l \Delta^{2/3} V^2 L$ pounds. The fuel consumption, however, is only $k l \Delta^{2/3} V^2 L$ and price q pounds per ton.

Net cost of fuel is therefore:

$$q k l \Delta^{2/3} V^2 L + (f - t) r k l \Delta^{2/3} V^2 L \text{ pounds} = (q + r f - r t) k l \Delta^{2/3} V^2 L \text{ pounds.}$$

Whence also virtual price of fuel consumed:

$$q' = (q + r f - r t) \text{ pounds per ton.}$$

3. Differentiating equation (3) for "best" speed, we have:

$$\frac{\partial E}{\partial V} = \frac{\phi \cdot 36,500}{P (\pi L V + L)^2} [(\pi L V + L) (f' C' - x T - 3 q' F) - \pi L V]$$

(Continued on page 400)

Cement and Concrete for Shipbuilding Purposes—II

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials' point of view.

THE Tentative Standard Specifications determine the consistency of the mix by a slump test in the manner described in the "Tentative Specifications for Workability of Concrete for Concrete Pavements" of the American Society for Testing Materials, D62-20T. These specifications measure the consistency by the amount of slump or loss in height of a freshly mixed column of concrete in the form of a truncated cone 12 inches high, 8 inches in diameter at the bottom and 4 inches in diameter at the top. The Tentative Standard Specifications leave the amount of slump to the determination of the engineer on the operation, but fix a maximum slump of 6 inches for reinforced concrete for thin vertical sections and columns, and 8 inches for thin confined horizontal sections. The Shipping Board specifications require the water to be limited to the minimum that will permit the concrete to be worked into every part of the form, to embed the reinforcing completely and to produce a dense and watertight concrete. They adopted a slump test which consisted of filling a hollow cylindrical mold 6 inches in diameter and 12 inches long with the concrete to be used, setting this on end on a plate of glass or finished metal immediately after filling it, and withdrawing the mold with a slow vertical pull. They specified that under no circumstances should any concrete be used in the construction of the vessel that showed by this test a slump or drop exceeding 75 percent of the original 12-inch height of the concrete cylinder.

PROPORTIONS OF INGREDIENTS IN CEMENT AND CONCRETE

The Portland cement, fine aggregate and coarse aggregate in concrete should be such as to produce a material of the necessary plasticity that will have the desired quality and strength. The workability as determined by the slump test and the compressive strength at 28 days age are the principal factors. A very usual construction mixture is one part by volume of Portland cement to two parts of fine aggregate and four parts of coarse aggregate. A bag of Portland cement weighs 94 pounds and is considered to be one cubic foot.

The Tentative Standard Specifications include tables which for various sizes of coarse aggregate and fine aggregate give the proportions of the ingredients that at certain consistencies may be expected to produce concrete of the compressive strength at 28 days, for which each table is made up. These specifications, however, require that concrete in sea water or exposed directly along the sea coast shall contain not less than $1\frac{1}{2}$ barrels (6 bags) of Portland cement per cubic yard in place; that concrete from 2 feet below low water to 2 feet above high water, or from a plane below to a plane above wave action, shall be made of a mixture containing not less than $1\frac{3}{4}$ barrels (7 bags) of Portland cement per cubic yard in place; and that slag, broken brick, soft limestone, soft sandstone or other porous or weak aggregates shall not be used.

Concrete below the ground line in alkali soils or water is required by the Tentative Standard Specifications to contain not less than $1\frac{3}{4}$ barrels (7 bags) of Portland cement per cubic yard in place.

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The specified Shipping Board mixes were as follows:

- Class A—1: $2\frac{1}{3}$: $1\frac{1}{3}$
 1 bag of Portland Cement
 $2\frac{1}{3}$ cubic feet of fine aggregate
 $1\frac{1}{3}$ cubic feet of coarse aggregate
- Class C—1: 2
 1 bag of Portland Cement
 2 cubic feet of fine aggregate.

The Class C mixture, which is cement or cement mortar rather than concrete, was allowed for the bilges and other equally difficult curved and warped surfaces where specifically authorized. All other structural concrete was specified to be Class A. In some cases the mix was made $1\frac{1}{2}$: $1\frac{1}{2}$.

Where joints have to be made in watertight construction on account of not being able to finish the work in one continuous operation, a heavy coating of neat Portland cement is required.

The mixes of cement for deck covering have been dealt with under that head, being generally 1:2. Classification society requirements for the protective cement coatings specified by them call for proportions of about 1:2.

CURING CONCRETE

The curing of concrete may be defined as the prevention of premature drying and it is essential to the development of high resistance to abrasion.

The Shipping Board required that for a period of at least two weeks after the forms were removed from any part of the concrete vessels the surface should be wetted down by sprinkling at least four times a day. In case of excessive heat they extended this to sprinkling the forms before removal after the concrete had been placed in them.

MATERIALS FOR WATERPROOFING CONCRETE

As can be readily appreciated, the concrete used in concrete ship construction should be made as waterproof as possible, in order to keep water from passing through the relatively thin walls, in order to protect the steel reinforcing from corrosion and consequent destruction and in order to protect the concrete itself from possible action of certain elements in the sea water. Much can be done in this direction by careful grading and mixture of the solid materials and the avoidance of an excessive amount of water, because the formation of the colloids previously referred to gives to concrete a considerable degree of watertightness. The density and watertightness can also be increased by vibrating the forms while the concrete is being poured and skillful handling generally. Special waterproofing is, however, advisable for the main structural parts of a vessel and those that are exposed to salt water. Materials for this purpose are of two general classes—integral waterproofer and surface waterproofer.

INTEGRAL WATERPROOFING

Integral waterproofing materials are also of two general classes—those which are primarily designed to increase the density of the concrete and those which are primarily designed to prevent water from wetting the surfaces of the pores, thus destroying their ability to draw water in. It

would seem to be a very difficult undertaking to find a material that can be added to a concrete mixture which will fill up pores caused by the evaporation of the water in excess of that necessary to hydrate or set the cement, although materials which will increase the fatness of the mix and make it easier to compact will decrease the porosity. It is not so difficult, however, to find a material that will in a great measure make the concrete water repellent.

It is well known that a liquid is drawn up on any surface which it wets by what is called capillary attraction and that, if this surface is the inside surface of a tube, it will be drawn up a considerable distance. If the liquid does not wet the surface, it is actually depressed at the surface and in such cases a very small tube offers considerable resistance to the ingress of the liquid. The porosity of concrete is of the nature of very small tubes or ducts. A water repellent material that will coat the surfaces of the pores should therefore be of value as an integral waterproofer.

The aims sought by the manufacturers of integral waterproofing compounds in whole or in part are:

Maximum permanent repellency.

Constituents that will develop colloids, and thus as far as possible fill up the pores.

A material that can be uniformly distributed through the concrete by means of the water.

A material that will not react with the concrete materials and injuriously affect the compressive and tensile strength.

A material that will, like soap used in washing, reduce the surface tension of the mixing water, or lubricate the mix, and thus make the concrete more dense.

Absence of inert or inactive elements.

Freedom from any element soluble in water after the work is completed.

At least one of the manufacturers of integral waterproofing claims to have a compound which fulfills all of the above desiderata. It is in the form of a paste containing a combination of aluminum as an insoluble soap with palmitic or stearic acids, and also other elements. Other materials used by different manufacturers of integral waterproofing are sodium soap, stearate of lime, glue solutions, water glass and various oils.

Integral waterprooferers that are largely or entirely pure silica are on the market and claim to increase the imperviousness of concrete by combining with the free lime which usually develops to a certain extent, thus fixing it and making it a permanent constituent of the concrete, whereas it would otherwise gradually dissolve out. Kieseguhr or diatomaceous earth and a product made from the pulverized shells of small sea animals are of this nature. Such materials were used on some of the Shipping Board's tankers in the nature of a lubricator, to fatten the concrete and thus make it more dense. They also aided in the density by being very finely ground. An efficient waterproofer of this character that does not introduce harmful results in other directions is also of value in preventing the destruction of surface coatings by the free lime. On some concrete ships exterior coatings containing oil have been attacked and destroyed by alkali salts brought to the surface, simply by testing tanks with water on the inside.

Builders of the concrete ship *Faith*, which was completed in San Francisco in 1918, are said to have made use of a material which relied on colloidal properties to plug up the pores.

Integral waterprooferers should be thoroughly tested as to their value and their effect on the concrete. Some of them tested for the Shipping Board by the Bureau of Standards were found to be of little or no value in reducing the absorption of water, or were found to reduce materially the compressive strength of the concrete. The Tentative Standard Specifications state definitely that integral waterproofing compounds shall not be used, thus taking the stand that they are necessarily valueless or harmful in other directions, which is not the case.

SURFACE WATERPROOFING

Surface waterproofing is the method that has to date been most generally relied upon and a great variety of paints, oils and other compounds for this purpose are on the market. A coating of this kind besides being waterproof should be sufficiently elastic to remain intact, if fine cracks develop in the concrete, and should adhere well to concrete. If the surface is to be later coated with oil paint, the waterproofer should be of a nature that such paints will adhere to.

There are a number of proprietary mastic compounds for waterproofing using various kinds of tar and pitch, asphalt and elaterite, generally with asbestos fiber. They, however, will not penetrate the concrete. It has been found that short fibered asbestos is a valuable constituent of such waterproofing coatings, in assisting them to remain intact over the fine cracks which develop in the surface of the concrete, and that its quality has quite a bearing on the smoothness, consistency and covering power of the paint. The Bureau of Standards recommended that a sample of the asbestos to be used should be submitted by the paint manufacturer and that specifications should require it to be ground into the paint by passing at least twice through the grinders.

There are also compounds using paraffin, aluminium stearate, ammonia soap, etc. Oil paints will not adhere to a concrete surface waterproofed with paraffin.

Linseed oil, raw tung oil (China wood oil) and rosin oil penetrate concrete rapidly. The first mentioned is the most valuable as surfaces treated with this oil take coatings of oil paint better than when treated with the other oils. The oil first absorbed is undoubtedly converted into the lime soap of the oil by saponification with the free lime in the concrete. This is a water repellent material and has therefore waterproofing properties. Subsequent applications of the oil oxidize and form an elastic film which has good waterproofing properties, and this film is under the surface, where it is most desirable that it should be.

Perilla oil is another gumming oil which cures by oxidation rather than by evaporation of volatile matter and has high saponification value. It has been found by test to be a valuable surface waterproofer, and to penetrate concrete to a depth of 3/16 inch or more and make it repellent to the water in the manner explained under the head of integral waterproofing, thus partaking of the nature of such waterprooferers. It has been found to be more resistant to the action of caustic lime than linseed oil and to furnish a good bond for succeeding coats of paint or varnish. To obtain best results such a coating should be applied as a saturated coat, i.e., in addition to the first general cover coat; subsequent touching-up coats should be applied to portions of the surface where the larger local porosity allows a quicker penetration. The saturation, however, should not be carried to the point where a film of the oil is left on the concrete surface. The oil should be received fresh from the manufacturer and stored in airtight containers until used. When exposed to the air in bulk it becomes somewhat fatty in time and when applied to the concrete gives a slow drying outer film. It may be expected to have in the long run a more waterproofing effect than spar varnish, since the original protective film of varnish, which does not penetrate, seems to soften and loosen with age.

Spar varnish makes a good waterproof coating and, when white lead pigment is ground into it in proportions of 40 to 45 percent of the pigment with 55 to 60 percent of varnish, a very serviceable, elastic waterproof paint with good body is formed. Such a paint is used for coating the pontoons of naval seaplanes. It is the gray enamel hereinafter referred to.

The Shipping Board tried out a process of coating the surface of the concrete with copper in the form of a metal spray. They found that the metal went into all of the nooks and crannies of the surface no matter how rough the surface

was; but that the particles of copper were somewhat oxidized and the coating was porous. They found also that the apparatus as made at that time would not stand up under continuous work and that it was therefore not satisfactory for large operations.

After careful research and the testing of a variety of special materials, some of which have not been referred to here, the Shipping Board adopted spar varnish for the outside of the hull and all surfaces in cargo holds and engine and boiler rooms, and applied it on some of the ships. The results obtained on the outside of the hulls were unsatisfactory, due largely to the action of the lime in the concrete on the linseed oil in the varnish; and the results obtained on the inside of the hull were unsatisfactory owing to the practical impossibility of making it dry thoroughly in such spaces.

The coatings specified by them for the interior surfaces of water ballast and fresh water tanks and the shaft tunnel and all interior hull surfaces where water might accumulate, except cargo spaces, were a bituminous primer, C.S.9, and coating C.S.10, in accordance with the following specifications.

BITUMINOUS HULL PAINT—C.S.9

This shall consist of an asphalt base thinned with petroleum distillate. The asphalt base shall meet the following requirements: Penetration at 77 degrees F. not more than 12 nor less than 8. Melting point not less than 205 degrees F. nor more than 220 degrees F. (ring and ball method).

Soluble in cold carbon bisulphide not less than 99.5 percent.

Organic matter insoluble in carbon bisulphide not more than 0.2 percent.

Ash, not more than 0.3 percent.

A thin flake of material shall be capable of slow bending without breaking.

The completed bituminous hull paint shall contain approximately 60 percent of the thinner and it shall, when applied with a brush to a glass plate, dry at least to a tacky state in not more than one hour and shall be free from tackiness in not more than five hours. Also it shall be such that it may be applied satisfactorily while cold by means of a compressed air paint spraying device when worked with a pressure of 60 to 70 pounds per square inch.

BITUMINOUS THICKENED HULL PAINT—C.S. 10

This paint shall be made by adding and grinding into the bituminous hull paint (Specification C.S. 9), approximately fifteen percent of extremely finely powdered silicious matter such as aluminum silicate, magnesium silicate, or a mixture of these, and approximately fifteen percent of short fibered inert mineral matter such as asbestos. No slaked lime nor calcium carbonate shall be used.

The thickened paint shall be applied with a brush and shall be such that a relatively thick paint film, which shall dry readily, will be obtained. This paint, therefore, shall have satisfactory brushing and spreading qualities.

After about two years of test and experimentation these were superseded by the following specifications C.S.37 and C.S.38, which were also extended to replace the varnish on the outside of the hulls and in the dry cargo holds.

BITUMINOUS PRIMER—C.S. 37

This shall consist of a mixture of 60 percent base and 40 percent mineral spirits.

The base shall be a mixture of:

"Texaco 34" 90 percent
Rubrax grade "B" 10 percent

The Texaco 34 asphalt shall meet the following requirements:

Melting point (ring and ball method).... 140 degrees F.
Penetration 45 degrees F.
Ductility 86 degrees F.

The Rubrax grade "B" asphalt shall meet the following requirements:

Melting point (ring and ball method).... 243 degrees F.
Penetration 7 degrees F.
Ductility 0 degrees F.
Solubility in CS₂ 99.9 percent

BITUMINOUS HULL PAINT—C.S. 38

This shall consist of a mixture of 50 percent base, 16.6 percent fibrous asbestos filler and 33.4 percent mineral spirits.

The base shall be a mixture of:

"Texaco 34" 90 percent
Rubrax grade "B" 10 percent

The asphalt requirements are as before mentioned.

The volatile mineral spirits in both specifications shall be a hydrocarbon distillate, water white, neutral clear and free from water. It shall have no darkening effect when mixed with basic carbonate white lead.

When 10 cubic centimeters are put in a glass crystallizing dish 2½ inches in diameter, and placed on a steam bath for 2½ hours, the residue shall not exceed .03 grams.

When tested according to the standard tests for paint thinners other than turpentine, prescribed by the American Society for Testing Materials, the flash point shall be not less than 29 degrees C. (85 degrees F.), in a closed tester, and in the distillation test, the first drop shall issue from the condenser at a temperature not below 129 degrees C. (265 degrees F.) and 97 percent shall distill below 243 degrees C. (470 degrees F.).

Good rules for the application of such coatings are: Before painting, all surface dust should be removed with a soft bristle brush and the surface should be as dry as possible and free from all surface water. The first coat of the thin paint, thinned as suggested before, shall then be applied and after drying it shall be inspected for brown and uncoated spots. These should be re-coated with the thin paint. About thirty-six hours shall elapse between the application of the thin paint and the first coat of the thick paint. This depends entirely upon weather conditions. The second coat can be applied with the paint sticky but in such condition that when rubbed with the hand no paint shall be removed. After the application of the second coat the paint should be allowed to dry twenty-four hours. The third is then applied and at least forty-eight hours should elapse before putting in the blocking. It is suggested that before putting in the blocking it be liberally dusted with powdered soapstone. All cement patches shall be allowed to cure at least three days and preferably longer before coating.

A heated asphaltic cement coating with a priming coat of the same mixture thinned with benzine or gasoline to the consistency of paint and applied cold was proposed for and the writer understands used upon the barges built by the United States Railroad Administration for service between New York City and Buffalo. It was submitted to the Bureau of Standards with a view toward ascertaining if the elasticity or life of the asphalt would be affected by the volatile oil in the priming coat; and it was their opinion that such would not be the case. The priming coat was necessary because a heated asphaltic cement coating applied direct to concrete will peel off of it upon cooling. The formula as proposed consisted of 100 parts of Bermudex refined asphalt mixed with 11½ parts of Craig oil flux at a temperature of about 300 degrees Fahrenheit.

One of the West Coast builders of the Shipping Board's concrete tankers recommended for the outside of the hull an application of magnesium fluosilicate, then a coat of perilla oil to full saturation, followed by a coat of a plastic concrete paint manufactured by one of the varnish manufacturers applied with a trowel, the surface being subsequently squeezed off, leaving the hull very smooth and every open air or bubble hole in the concrete filled with a hard material that water did not appear to affect in the least. This was to be covered with two coats of Elaterite. It is not known that any concrete ships have been coated in this manner. Tests made by the Shipping Board of the Elaterite alone were unsatisfactory.

The Tentative Standard Specifications state that membrane waterproofing, consisting of a coating reinforced by fabric, felt, or similar toughening material, shall be used in basements, pits, shaft tunnels, bridge floors, retaining walls and similar structures where an added waterproofing protection is desired.

(To be continued)

A Simple Chronograph for Launching Observations

By John P. Comstock

IN the timing of a recent launch, a chronograph of extremely simple construction was used. The accuracy with which it recorded the speed of the ship is an excellent illustration of how a correctly designed apparatus may be made to serve a purpose, even though it lack expensive finish.

Formerly, launches at this yard have been timed in the usual manner, by painting a series of marks on the ship's side, and timing these with a stop-watch. Two observers stand at a sight, which is in line with the stern of the ship. One holds a stop-watch, on the crystal of which is pasted



Fig. 1



Fig. 2

a narrow ring of paper, and the other observes the transit of the marks on the ship past the sight. The watch is started when the ship starts, and as each mark passes the sight, the observer taps the shoulder of the man with the watch, and the latter marks on the ring of paper the position of the watch-hand. As a check, a second pair of observers takes a duplicate record.

ERRORS TO WHICH STOP-WATCH METHOD IS SUBJECT

This method is subject to the following personal errors, which, with the exception of the third, may be in either direction:

1. The error in estimating the instant of transit of the mark.
2. The error between the estimated instant of transit and the signal to the man with the watch.

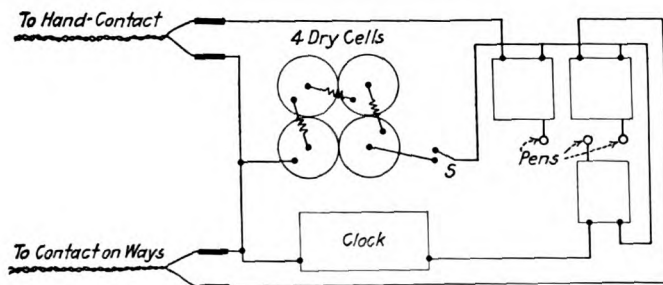


Fig. 3.—Wiring Diagram

3. The lag between the signal and the marking of the watch.
4. The error between the mark and the actual position of the watch-hand.

The start of the ship, in particular, is sure to be recorded too late and, in general, it cannot be said with certainty that the time recorded is within a half-second in either direction of the correct time.

During the first few moments of the launch, where the

acceleration curve is most useful in determining the coefficient of friction, unmixed with water-resistance, the above method is especially unsatisfactory, because points cannot be obtained as close together as would be desirable for this rapidly changing portion of the distance-curve, and because the observers, not having gotten into the swing of their work, are especially inaccurate at the start.

DESCRIPTION OF THE CHRONOGRAPH

These considerations led to the design of the chronograph shown in Fig. 1. It consists essentially of three pens, beneath which is drawn a strip of paper. The pens are held by ordinary electric bells, from which the gongs and their supporting arms have been removed. The balls on the hammers are replaced by clips to hold the pens. The vibrators are short-circuited with drops of solder.

The middle pen is operated by the escapement of an alarm-clock, which closes a circuit, and so makes a jog in the line every half-second. One of the other pens is operated by a contactor on the ground-ways, which is closed momentarily as each of a series of stops on the sliding-ways reaches it. The third pen is operated by a contact-maker closed by hand at the sights before mentioned, as the marks on the ship's side pass the station. Thus two independent records are obtained. A wiring diagram is shown in Fig 3.

The clock which operates the middle pen is shown in Fig. 2. The works of an ordinary alarm-clock are mounted on a board, which also carries a copper shelf, to which is soldered a cup made from a revolver-shell. This cup holds a drop of mercury, and a small wire soldered to the escapement lever dips into the mercury at every stroke, thus closing a circuit. One wire is led to the shelf, the other to the frame of the clock. The clock is so made that the mercury contact occurs every half-second. Of course any clock may be used, after timing the beat.

The paper ribbon—an ordinary adding-machine ribbon

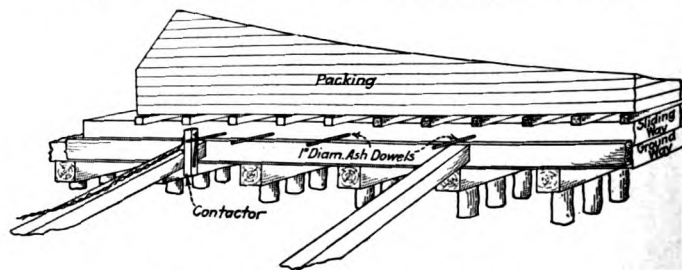


Fig. 5.—Arrangement on the Ways

was used—is wound from one roller beneath the pens onto another roller by a hand crank. The speed of the paper does not need to be exactly constant, for the number of seconds recorded between contacts will be the same, whether the paper is moving rapidly or slowly.

THE CONTACTOR

The contactor on the ground-ways is shown in Fig. 4. It consists of a spring of 1-inch by $\frac{1}{8}$ -inch steel, about 12

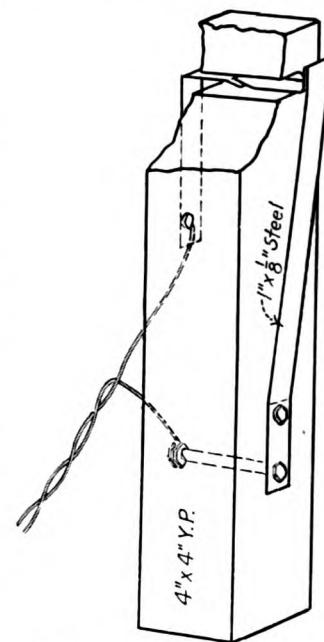


Fig. 4.—The Contactor

inches long, mounted on a piece of 4-inch by 4-inch pine. This is firmly fastened to a ground-way shore, far enough out to clear all obstructions on the sliding-ways, and as far aft as possible. When the spring is pressed home, it makes a rubbing contact with another piece of steel as shown. The

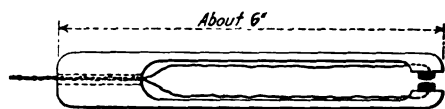


Fig. 6.—The Hand Contact-Maker

contact is made in the middle of the piece of pine, where it is well protected from flying grease from the ways, or from any other interference.

The contactor is closed by 1-inch diameter ash dowels, driven into holes in the sliding-ways, and long enough to provide for the greatest lateral movement that can occur. These dowels come against the contactor, close the spring, and then break off. The first one is placed just ahead of the contactor, so as to close it the instant that the ship starts. These dowels can be placed much closer together than can

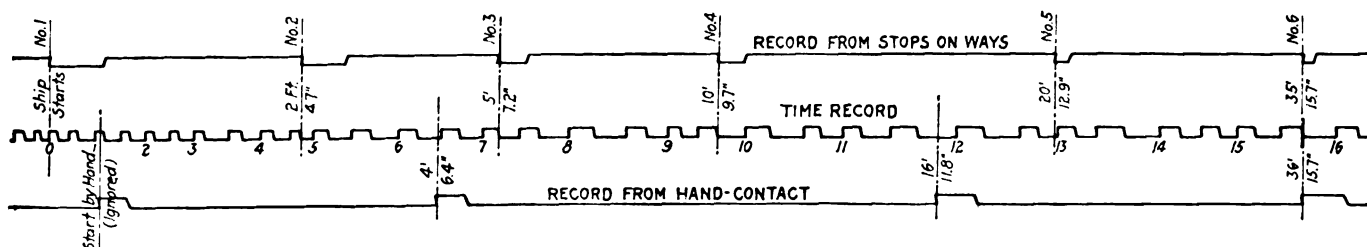


Fig. 7.—Section of the Ribbon

the marks on the ship's side, as the chronograph will record them as fast as they come. In this instance they were spaced so as to give contacts at roughly constant intervals of one second. The arrangement on the ways is shown in Fig. 5. The contact-maker used by the observer at the sights is shown in Fig. 6.

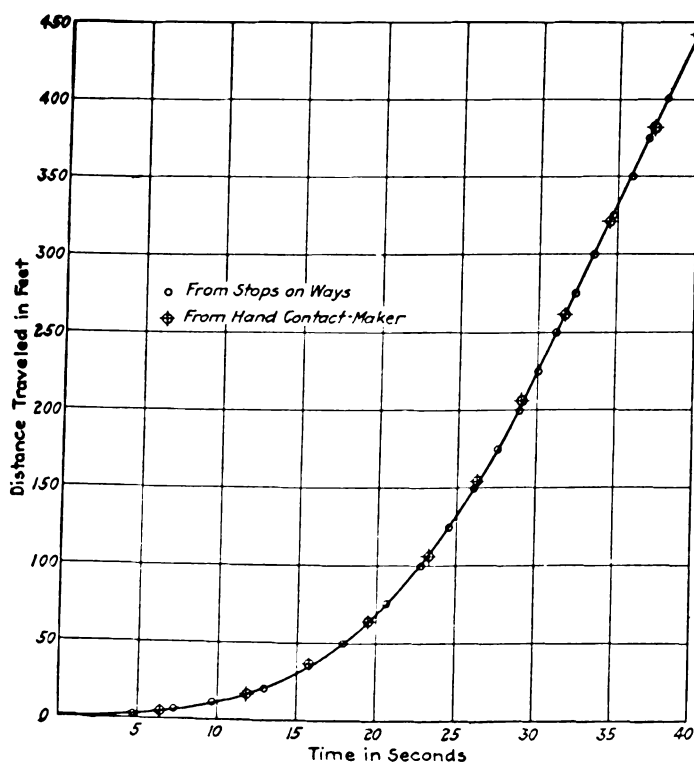


Fig. 8.—Time-Distance Curve

RECORD OBTAINED FROM THE APPARATUS

The ribbon obtained from the launching is shown in Fig. 7. The middle line is the time record, the upper line is the record of the automatic contact on the ground-ways, and the lower line is the record from the contact-maker operated by the observer. The time-distance curves from these data are plotted in Fig. 8. It is impossible to draw two separate curves. The points come much closer to a curve than any stop-watch record that has come to the writer's attention. In fact, it is difficult to put a satisfactory curve through the usual stop-watch data, and the resulting coefficient of friction does not deserve the confidence that can be given the coefficient derived from the curves shown here.

SUMMARY OF ADVANTAGES

To summarize the advantages found in using the chronograph as compared with the stop-watch method:

The work is done by two men instead of four.

The chronograph costs no more than one of the two watches.

Points on the curve can be obtained much closer together than can be marked on a watch.

Each of the records obtained is far more accurate than

the stop-watch records—the automatic record being accurate probably to one-tenth of a second, and the hand-recorded time being accurate to about one-fifth of a second.

Unusual Opportunity for Young Men to Secure a Technical Education

ALTHOUGH at the present time the outlook for shipbuilding in this country is not very roseate, it will not long continue to be depressed and there will be ample opportunities for young men to find employment in naval architecture and shipbuilding. At the Webb Institute of Naval Architecture at Sedgwick avenue and 188th street, New York City, founded by the generosity of America's greatest shipbuilder, Mr. William H. Webb, and constituting the only educational institution in this country devoted solely to naval architecture and marine engineering, any young American, between the ages of 15 and 21, can secure a thorough education without any cost to himself whatever. This actually includes board and lodging throughout the entire course and represents one of the finest opportunities for ambitious youths that exist anywhere.

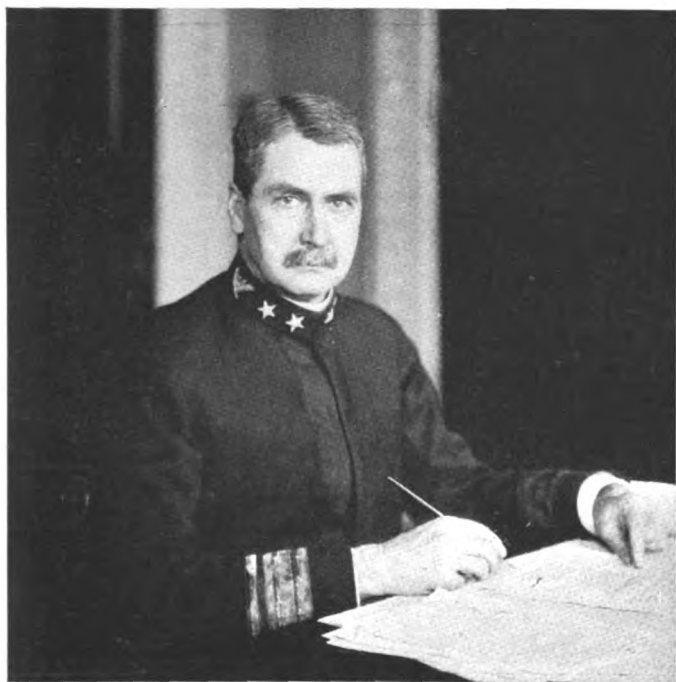
The young men must, of course, be of good character, and have a preliminary education equivalent to that given at the recognized high schools. No matter how many vacancies may exist, the standards are never lowered. They are such, however, that any ambitious youth may seek to obtain an appointment, if he is diligent and applies his attention to the necessary studies. Webb graduates are recognized at all the great shipbuilding centers as splendidly prepared, and they usually have no difficulty in obtaining good positions.

Full particulars as to the examinations, which are to be held in September next, will be furnished by the Resident Manager on application to the address above given.

Admiral Taylor, Chief Constructor of the United States Navy, to Resign on July 1

REAR ADMIRAL DAVID W. TAYLOR, chief constructor of the Bureau of Construction and Repair, U. S. Navy, has tendered his resignation to take effect July 1. Captain John D. Beuret has been nominated by President Harding to succeed him as chief constructor with the rank of rear admiral.

Admiral Taylor has been chief of the bureau for more than eight years and both foreign and American naval officers concede him to be one of the most distinguished technical officers that ever graduated from the Naval Academy. The



Rear Admiral David W. Taylor, U. S. N.

design of modern warships of all navies has been more influenced by his work than by any other single individual.

As a student, Admiral Taylor held a record that has never been equalled for the general average of standing in all studies both at the Naval Academy and at the Royal College of Naval Constructors where he was sent under an agreement with the British Government to complete his professional studies.

It was largely due to his efforts that the model basin at the Washington navy yard was established. Through the use of this basin it has been possible through tests on hull models to determine accurately in advance of the actual construction of giant warships exactly what horsepower was needed to assure a given speed. It was while Admiral Taylor was at work at this basin that he worked out through a long series of tests with models the data for his books covering the subjects of resistance of ships and screw propulsion and the speed and power of ships which are international standard works today.

The high esteem in which Admiral Taylor is held in England was shown when the *Olympic* collided with the British cruiser *Hawk* in the Mersey river a few years before the war. The British Admiralty and the British Board of Trade were unable to come to a decision as to the responsibility for the collision and the United States Government was requested jointly by the British Admiralty and the White Star Line to send Admiral Taylor to England to give

expert testimony. He went over there and explained the mystery by showing how the vast hull of the *Olympic* would set up drawing forces on the small hull of the cruiser when passing slowly by her.

Admiral Taylor has been a prominent member of the Society of Naval Architects and Marine Engineers. During the war he was a member and is still a member of the Advisory Committee on Aeronautics, chairman of the Joint Army and Navy Zeppelin Board and Army and Navy Aircraft Board. Hundreds of millions of dollars of contracts for new naval ships were virtually under his control during the war and it was also his bureau that developed the monster sea planes, including the *N.C.-4*, which successfully crossed the Atlantic ocean.

Thousands of Feet of Plywood Panels to Be Installed on the Leviathan

THE reconditioning of large vessels such as the *Leviathan* is now accomplished more rapidly than heretofore due to the fact that there is little or no delay in joiner work. The joiner work on most of the German liners taken over by this Government was made of plywood panels. Until recently no facilities were available in this country for doing this large panel work but during the war, in Grand Rapids and Ludington, Mich., were established the large plants of the Haskelite Manufacturing Corporation, where eight large hot plate presses were installed for the purpose of making large panels by the hot plate method using blood albumen glue, the glue which during the war ranked highest by Government test of all glues tested.

On the *Leviathan* there will be thousands of feet of large Haskelite panels, many of which will be 7 feet by 11 feet and larger. In the manufacture of panels by the Haskelite or hot plate method each panel is handled separately and given individual attention in its manufacture. In the large presses, shown in Fig. 1, there are three openings. In each opening one panel is placed at a time. The panels are subjected to heat of 212 degrees F. and over and a pressure up to 250 pounds per square inch. The actual making of a panel and the setting of the glue in these presses takes less than four minutes for each pressing on panels that are not in excess of 5 feet by 8 feet. On longer panels they are pressed a section at a time, the operation being continuous as the plies of wood are fed through the openings 5 or 8 feet at a time depending on which way the press is used.

The fact that these panels can be made up so quickly, are lighter in weight, more economical in space, more sanitary and more attractive, and can be installed so much more rapidly than tongue and groove bulkheads has made them popular in many of the largest yards on both coasts.

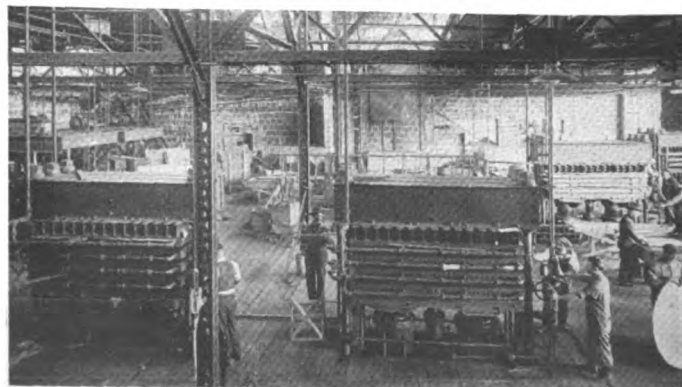


Fig. 1.—Hydraulic Presses at Haskelite Plant Used for Making Large Shipbuilding Panels

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Development of Shell Plating

Q. (1157).—In the development of shell plate in the mold loft by the triangulation method, the question as to which diagonal is the correct one to use has arisen. The triangulation as we work it is the expansion of the plate edge as picked up from the body plan, and the girth (not the true, but the unexpanded girth) with the diagonal.

A. (1157).—The method illustrated in your sketches is in general accord with the principles of the so-called simplified triangulation method. The use of this method should be confined to plates which have very little shape because of the correction for the girths along frames which must be

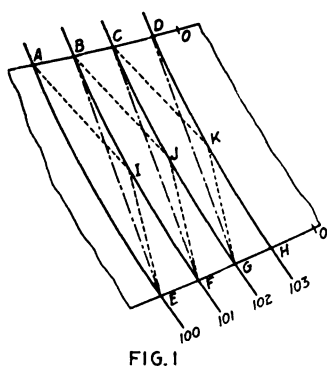


FIG. 1

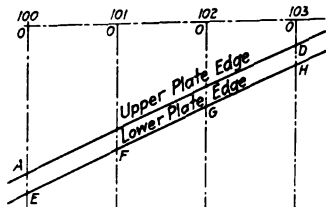


FIG. 2

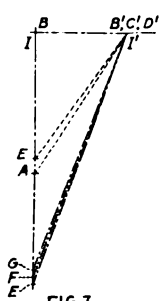


FIG. 3

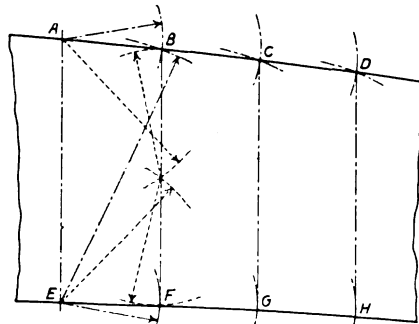


FIG. 4

introduced in connection with this method for plates having much bend and to which you refer as your last step.

You do not specify which diagonals you have in mind in your question. Instead of those shown, EB, FC, etc., it would, of course, give equally satisfactory results if we used AF, BG, etc.

The standard method of triangulation which is very accurate, even for plates having a fair amount of curvature, differs from that shown in its use of two rather than one diagonal. This method is shown, in so far as it differs from the simplified method, by dotted lines in the figures. In principle the two methods are the same but the use of the two diagonals EI and AI, instead of EB, eliminates the necessity of correcting for the girths along the frames. A

development of this method is used for plates of pronounced curvature such as bilge plates.

Problem of the Hull and Its Screw Propeller

Q. (1160).—Referring to the April, 1921, number and Admiral Dyson's article, "Problem of the Hull and its Screw Propeller," on page 320 a formula is given for "the mean tip clearance." As I understand the article, this formula is for wing screws. What will be the formula for "tip clearance" for propellers of single screw ships?

On page 319, how is the "K" coefficient to be determined for a ship of Type 1; also for single screw type 3, twin screw type 2, and single screw vessels, type 2, twin screw type 3, if in each case the slip K. B. C. is .7 and the mean T. C. 2.5? I fail to understand how the result is to be read on the curve after the point is spotted for mean T. C., and slip K. B. C.

A. (1160).—The formula to which you refer is to be used only for Type 1 vessels having wing propellers. No formulas are to be used for other types of vessels or other arrangements of propellers.

In designing Type 2 single screw vessels and Type 3 deep draft twin screw vessels take their K value from Curve C_3 - C_2 , while Types 1 and 3 single screw, Type 2 twin screw and Type 3 twin screw shallow draft vessels take their value of K from Curve C_1 - C_2 .

For a Type 1 vessel having wing screws, plot your slip K. B. C.=.7 and Mean T. C.=2.5 on the chart referred to and it will be seen to fall between the "Curves of K" marked 1.2 and 1.175. The interpolated value would be approximately 1.18.

For all other types of vessel and number of screws the slip K. B. C. only is to be considered in design with the following results: K for single screw Type 3=1.35. K for twin screw Type 2=1.35. K for single screw vessels Type 2=1.093. K for twin screw Type 3, shallow draft=1.35. K for twin screw Type 3, deep draft=1.093.

Oil Heating Coils in Boiler Furnace

Q. (1161).—Why would not a coil of pipe within the furnace adjustable as to location to secure the proper temperature be better than steam heaters for an oil burning installation, and what would be its advantage or disadvantages?

A. (1161).—The placing of fuel oil heating coils in a boiler furnace has but few advantages and many serious disadvantages. Such an installation would be impossible to control as to temperature no matter where placed, as the intensity of the heat in the furnace will vary as the number of burners operating is increased or decreased. In case the heat became too intense or should there be for any reason a stoppage in flow of fuel, the oil would carbonize in the coils, making it impossible to start up again until the coils had been taken out and cleaned.

The coils would be out of reach of inspection and repair, both of which would have to be frequently made due to burning of the coils. The heater could not be by-passed because, should the oil be left in, it would carbonize, as stated above; and if drained off the coils would burn through. In case of burning out while operating, a stream of oil would be thrown into the furnace; which would probably cause the boiler to pant badly with perhaps serious results.

... About the only points in favor of such a system would be the saving of space in the boiler room or in case there should be no available steam.

LETTERS TO THE EDITOR

Marine Boilers

In the April, 1922, issue is an interesting letter by Mr. F. W. Dean, of Boston, Mass., relative to marine boilers which does not accurately cover this subject.

Generally speaking, all reliable published tests to date

show that the watertube boiler is more efficient than the fire tube type whether of Scotch marine design or externally fired as used in shore plants. This fundamental fact is further proved by the trend of modern development both ashore or afloat as is clearly shown by the increasing numbers of watertube boilers being purchased and installed as compared with the decreasing number of fire tube boilers being used. This, in the final analysis, is the best evidence of the superiority of the watertube boiler.

Referring specifically to the bent tube type boilers in the

Table I.—Results of Tests of Scotch Boilers by Emergency Fleet Corporation.

	37	38	39	40	41	42
1 Test number	1-21-21	1-22-21	1-24-21	1-27-21	1-28-21	1-28-21
2 Date	Emergency-Fleet Corporation.	Emergency-Fleet Corporation.	Emergency-Fleet Corporation.	Boiler Test Plant, Chester, Pa.	Boiler Test Plant, Chester, Pa.	Boiler Test Plant, Chester, Pa.
3 Location	3,000	4,063	3,004	4,006	3,021	3,043
4 Duration	Hours	Hours	Hours	Hours	Hours	Hours
5 Type of boiler.....	Scotch Marine.	Foster superheater, air heater.	Scotch Marine with waste heat superheater.	Scotch Marine with waste heat superheater.	Scotch Marine with waste heat superheater.	Scotch Marine with waste heat superheater.
6 Heating surface	Sq. Ft. 3,022.4	Sq. Ft. 3,022.4	Sq. Ft. 3,022.4	Sq. Ft. 3,022.4	Sq. Ft. 3,022.4	Sq. Ft. 3,022.4
7 Draft area through tubes.....	Sq. Ft. 11.94	Sq. Ft. 11.94	Sq. Ft. 11.94	Sq. Ft. 11.94	Sq. Ft. 11.94	Sq. Ft. 11.94
8 Combustion space	Cu. Ft. 544.7	Cu. Ft. 544.7	Cu. Ft. 544.7	Cu. Ft. 588.4	Cu. Ft. 588.4	Cu. Ft. 588.4
9 Superheating surface	Sq. Ft. 774	Sq. Ft. 774	Sq. Ft. 774	Sq. Ft. 774	Sq. Ft. 774	Sq. Ft. 774
10 Air heating surface	Sq. Ft. 1,220	Sq. Ft. 1,220	Sq. Ft. 1,220	Sq. Ft. 1,220	Sq. Ft. 1,220	Sq. Ft. 1,220
11 Burner	Coen	Coen	Coen	"Todd"	"Todd"	"Todd"
12 Register	Howden forced draft	Howden forced draft	Howden forced draft	front furnace.	front furnace.	front furnace.
13 Size of tip	.086	.051	.063	.073	.076	.086
14 Retarders	Yes	Yes	Yes	Yes	Yes	Yes
15 Atomizer, S = Slots	2-S 1/32"	2-S 1/32"	2-S 1/32"	2-S 5/64"	2-S 5/64"	2-S 5/64"
16 Venturi—minimum diameter	13	13	13	13	13	13
17 Kind of fuel	Oil	Oil	Oil	Oil	Oil	Oil
18 How fired	Forced draft	Forced draft	Forced draft	Forced draft	Forced draft	Forced draft
19 Total amount of fuel as fired.....	Lbs. 5,347	Lbs. 3,772	Lbs. 3,240	Lbs. 3,290	Lbs. 3,456	Lbs. 4,236
20 Temperature oil at burners.....	°F. 245	°F. 244	°F. 235	°F. 268	°F. 258	°F. 251
21 Pressure oil at burners.....	Lbs. 202	Lbs. 152	Lbs. 148	Lbs. 115	Lbs. 122	Lbs. 140
22 Moisture	% .3	% .5	% .2	% .2	% .2	% .2
23 Hydrogen	% 11.32	% 11.17	% 10.99	% 11.46	% 11.57	% 11.57
24 Carbon	% 82.73	% 82.64	% 82.72	% 83.83	% 84.71	% 84.71
25 Sulphur	% 4.0	% 4.0	% 3.8	% 3.5	% 3.6	% 3.6
26 Viscosity, Saybolt (187° and 122° F.).....				280	280	280
27 Baumé				15.4	15.4	15.4
28 Specific gravity				.963	.963	.963
29 Flash point	°F. 234	°F. 234	°F. 234	°F. 234	°F. 234	°F. 234
30 Burning point	°F. 18,324	°F. 18,325	°F. 18,326	°F. 18,390	°F. 18,392	°F. 18,382
31 Heat value	B.T.U. 18,324	B.T.U. 18,325	B.T.U. 18,326	B.T.U. 18,390	B.T.U. 18,392	B.T.U. 18,382
32 Fuel as fired	Lbs. 1,782	Lbs. 928	Lbs. 1,079	Lbs. 821	Lbs. 1,144	Lbs. 1,392
33 Fuel per burner.....	Lbs. 594	Lbs. 309	Lbs. 360	Lbs. 274	Lbs. 381	Lbs. 464
34 Fuel per sq. ft. heating surface.....	Lbs. .590	Lbs. .307	Lbs. .357	Lbs. .272	Lbs. .379	Lbs. .461
35 Fuel per cu. ft. combustion space.....	Lbs. 3.27	Lbs. 1.70	Lbs. 1.98	Lbs. 1.40	Lbs. 1.94	Lbs. 2.37
36 Furnace	H ₂ O—Ins. +.41	H ₂ O—Ins. +.06	H ₂ O—Ins. +.06	H ₂ O—Ins. +.19	H ₂ O—Ins. +.47	H ₂ O—Ins. +.88
37 Below superheater	H ₂ O—Ins. —.06	H ₂ O—Ins. —.10	H ₂ O—Ins. —.08	H ₂ O—Ins. —.03	H ₂ O—Ins. —.12	H ₂ O—Ins. —.13
38 Below air heater.....	H ₂ O—Ins. —.07	H ₂ O—Ins. —.09	H ₂ O—Ins. —.09	H ₂ O—Ins. —.11	H ₂ O—Ins. —.09	H ₂ O—Ins. —.06
39 Base of stack.....	H ₂ O—Ins. —.12	H ₂ O—Ins. —.13	H ₂ O—Ins. —.08	H ₂ O—Ins. —.03	H ₂ O—Ins. —.07	H ₂ O—Ins. —.08
40 Carbon dioxide (CO ₂).....	% 13.6	% 11.5	% 12.3	% 12.3	% 13.5	% 13
41 Oxygen (O ₂)	% 2.6	% 5.3	% 4.3	% 4.1	% 1.9	% 3.4
42 Carbon monoxide (CO).....	% .10	% 0	% .06	% .02	% .12	% .02
43 Nitrogen (N ₂)	% 83.7	% 83.2	% 83.34	% 83.68	% 84.48	% 83.58
44 Gas leaving boiler	°F. 652	°F. 529	°F. 540	°F. 509	°F. 536	°F. 577
45 Gas leaving superheater	°F. 552	°F. 464	°F. 467	°F. 450	°F. 473	°F. 495
46 Gas leaving air heater.....	°F. 420	°F. 340	°F. 346	°F. 324	°F. 349	°F. 371
47 Weight gas per lb. of carbon.....	Lbs. 18.42	Lbs. 21.78	Lbs. 20.32	Lbs. 20.38	Lbs. 18.50	Lbs. 19.34
48 Weight gas per lb. fuel as fired.....	Lbs. 15.24	Lbs. 18.00	Lbs. 16.81	Lbs. 17.08	Lbs. 15.67	Lbs. 16.38
49 Air pressure at fan.....	H ₂ O—Ins. 2.58	H ₂ O—Ins. .72	H ₂ O—Ins. .95	H ₂ O—Ins. .6	H ₂ O—Ins. 1.42	H ₂ O—Ins. 2.5
50 Temperature of atmosphere.....	°F. 56	°F. 47	°F. 41	°F. 67	°F. 41	°F. 46
51 Temperature of boiler room near fan.....	°F. 77	°F. 73	°F. 65	°F. 67	°F. 68	°F. 74
52 Temperature of air at furnace.....	°F. 230	°F. 207	°F. 201	°F. 215	°F. 209	°F. 224
53 Barometer	Ins. Hg. 30.18	Ins. Hg. 30.19	Ins. Hg. 30.10	Ins. Hg. 30.41	Ins. Hg. 30.28	Ins. Hg. 30.27
54 Relative humidity	% 72	% 82	% 78	% 81	% 75	% 75
55 Temperature boiler room—true.....	°F.	°F.	°F.	°F.	°F.	°F.
56 Radiant temperature of boiler room.....	°F.	°F.	°F.	°F.	°F.	°F.
57 Smoke-Ringelmann scale .....	.....	.....	.....	.....	.....	.....
58 Boiler pressure (gage).....	Lbs. Sq. In. 174	Lbs. Sq. In. 166	Lbs. Sq. In. 174	Lbs. Sq. In. 174	Lbs. Sq. In. 171	Lbs. Sq. In. 172
59 Temperature of water to boiler.....	°F. 198	°F. 222	°F. 208	°F. 236	°F. 222	°F. 223
60 Temperature of steam in calorimeter.....	°F. 301	°F. 300	°F. 300	°F. 300	°F. 300	°F. 300
61 Moisture in steam.....	% .59	% .56	% .64	% .64	% .61	% .62
62 Temperature of saturated steam.....	°F. 377	°F. 374	°F. 377	°F. 377	°F. 376	°F. 376
63 Temperature of superheated steam.....	°F. 418	°F. 396	°F. 398	°F. 384	°F. 397	°F. 408
64 Degrees superheat	°F. 41	°F. 22	°F. 21	°F. 7	°F. 21	°F. 32
65 Temperature of front of boiler bottom.....	°F. 380	°F. 376	°F. 379	°F. 379	°F. 378	°F. 378
66 Temperature of rear of boiler bottom.....	°F. 384	°F. 378	°F. 384	°F. 384	°F. 383	°F. 383
67 Factor of evaporation, steam from boiler.....	1.063	1.037	1.052	1.023	1.038	1.037
68 Factor of evaporation, steam from superheater.....	1.089	1.052	1.067	1.028	1.052	1.058
69 Pressure drop through superheater.....	Ins. Hg. 6.9	Ins. Hg. 2.0	Ins. Hg. 2.6	Ins. Hg. 1.6	Ins. Hg. 2.8	Ins. Hg. 4.3
70 Total weight of water fed to boiler.....	Lbs. 76,430	Lbs. 57,716	Lbs. 49,456	Lbs. 50,603	Lbs. 52,250	Lbs. 64,262
71 Actual evaporation	Lbs. 25,477	Lbs. 14,207	Lbs. 16,463	Lbs. 12,632	Lbs. 17,296	Lbs. 21,118
72 Evaporation corrected for moisture.....	Lbs. 25,327	Lbs. 14,127	Lbs. 16,358	Lbs. 12,551	Lbs. 17,190	Lbs. 20,987
73 Equivalent evaporation steam from boiler.....	Lbs. 26,922	Lbs. 14,650	Lbs. 17,209	Lbs. 12,840	Lbs. 17,843	Lbs. 21,764
74 Equivalent evaporation steam from superheater.....	Lbs. 27,744	Lbs. 14,946	Lbs. 17,566	Lbs. 12,986	Lbs. 18,195	Lbs. 22,343
75 Actual evaporation per sq. ft. heating surface.....	Lbs. 8.43	Lbs. 4.70	Lbs. 5.45	Lbs. 4.18	Lbs. 5.72	Lbs. 6.99
76 Equiv. evap. superheated steam per sq. ft. H. S. & S. H. S.	Lbs. 7.31	Lbs. 3.94	Lbs. 4.63	Lbs. 3.42	Lbs. 4.79	Lbs. 5.89
77 Equiv. evap. steam from boiler per sq. ft. H. S.	Lbs. 8.91	Lbs. 4.85	Lbs. 5.69	Lbs. 4.25	Lbs. 5.90	Lbs. 7.20
78 Actual evaporation per lb. fuel as fired.....	Lbs. 14.30	Lbs. 15.30	Lbs. 15.26	Lbs. 15.38	Lbs. 15.12	Lbs. 15.17
79 Equiv. evap. steam from boiler, fuel fired.....	Lbs. 15.11	Lbs. 15.79	Lbs. 15.95	Lbs. 15.64	Lbs. 15.60	Lbs. 15.64
80 Equiv. evap. steam from superheater, fuel fired.....	Lbs. 15.57	Lbs. 16.10	Lbs. 16.28	Lbs. 15.81	Lbs. 15.91	Lbs. 16.05
81 Boiler and superheater based on fuel fired.....	% 82.5	% 85.3	% 86.2	% 83.43	% 83.9	% 84.73
82 Boiler based on fuel fired.....	% 80.0	% 83.6	% 84.5	% 82.52	% 82.31	% 82.56
83 Heat absorbed by boiler and superheater.....	B.T.U. 15,109	B.T.U. 82.5	B.T.U. 15,623	B.T.U. 85.3	B.T.U. 15,798	B.T.U. 86.2
84 Loss due to moisture in fuel.....	% 3	% 5	% 2	% 2	% 2	% 2
85 Loss due to burning hydrogen in fuel.....	% 1,065	% 5.8	% 1,005	% 5.5	% 999	% 5.5
86 Loss carried away in dry gases.....	% 695	% 3.8	% 566	% 3.1	% 585	% 3.2
87 Loss due to carbon monoxide.....	% 61	% .3	% 0	% .41	% .2	% .14
88 Loss unaccounted for	% 1,391	% 7.6	% 1,126	% 6.1	% 901	% 4.9
89 Heat in fuel as fired per pound.....	B.T.U. 18,324	B.T.U. 100	B.T.U. 18,325	B.T.U. 100	B.T.U. 18,326	B.T.U. 100

Berengaria, Leviathan, Great Northern, Northern Pacific and some of the "State" ships of the Shipping Board, the four ships mentioned have large tubes; namely, 2-inch, which if properly handled and fed with pure feed water are satisfactory for merchant marine service. The "State" ships built by the Bethlehem Shipbuilding Corporation at Sparrows Point, Md., have small bent tube type Yarrow boilers; namely, 1-inch and 1¼-inch. These tubes, while satisfactory in the Navy, have not proven satisfactory in the merchant marine as it is impossible to clean them internally with any present day known methods. The boilers of the *Great Northern* and *Northern Pacific* are a modified two-drum type designed by Mr. John Mitten, chief engineer, Wm. Cramp and Sons Ship and Engine Building Company, and installed by the Babcock & Wilcox Company.

The Emergency Fleet Corporation has tested out both Scotch and watertube boilers. A comparison of the two sets of tests does not show any superiority in efficiency for the Scotch boiler. In the case of the Scotch boiler tested by them it was fitted with a Foster waste heat superheater and a Howden type forced draft air heater. Adding the heat absorbed by these two auxiliary devices the efficiency of the Scotch boiler is as shown in the accompanying table of tests. So far as I know, these are the only reliable tests made of a Scotch marine boiler.

Any boiler steaming test that will not bear the careful analysis of a heat balance can hardly be considered reliable. It will be noted from the heat balance of the tests quoted that with the highest efficiency shown, namely, 84.3 percent, there was an unaccounted loss of less than 2 percent. In other words it is possible with an exceptionally careful testing crew, having all the known scientific apparatus available, to obtain approximately 86 percent efficiency from a Scotch boiler, a waste heat type superheater and an air heater. Some of the British tests shown in the table attached to Mr. Dean's paper have the impossible efficiency of 89.5 percent and therefore can hardly be considered reliable.

There are no known similar tests of a watertube boiler fitted with the waste heat absorbing devices which were used to increase the efficiency of this Scotch boiler. There are, however, reliable tests published of watertube boilers having efficiencies of over 84 percent without the aid of these auxiliary heat absorbing devices which are required by the Scotch boiler to equal the performance of the watertube boiler.

In the past, at relatively low pressures, there was unquestionably a field for the Scotch boiler. In the future, with the demand for increased economy, there will be little if any field for the Scotch boiler, particularly as increased economy necessarily means higher steam pressures.

Jos. J. NELIS, Secretary,
New York. Foster Marine Boiler Corporation.

Information Wanted

Joseph Wolff, chief engineer of the new White Star liner *Majestic*, has an important personal quest to take up in seeking a younger brother who dropped out of sight at Oakland, California, two years ago and has not been heard from since by his family, who live in England.

The man sought is Fred Wolfe—the brothers spell their surnames differently—aged 37. During the war he was employed as an engineer on the Red Star Line steamship *Lapland*, plying between New York and Antwerp. He left that occupation to engage in war work, which took him to Oakland, where he was employed as a machinist in a shipyard. His last address known to his brother was 426 26th street, Oakland.

Wolfe last communicated with his family in March, 1920, when he appeared to be in good health and spirits. He was always a dutiful father—he was a widower with two children

—and had always communicated regularly with his people. When his letters ceased, his brother became anxious and wrote to Oakland, but without learning the circumstances connected with his brother's leaving there.

Chief Engineer Wolff is prepared to seek information of his brother through every possible source. Telegraphic information may be sent him care of *S. S. Majestic*, White Star Line, Pier 59 North River, New York.

NEW BOOKS

THE ENGINEERING INDEX, 1921. Size, 6½ by 9¼ inches. Pages, 584. New York, 1922: The American Society of Mechanical Engineers.

The current issue of The Engineering Index contains over 14,000 items referring to articles in some 600 engineering and allied technical publications published in 1921. In selecting these items the engineering staff of the American Society of Mechanical Engineers has reviewed the 1,200-odd periodicals, reports and other publications regularly received during the year by the Engineering Societies Library, New York, and which, it is believed, comprise the most complete collection of scientific and engineering publications in the world. The Index, therefore, gives to the engineer or scientist a key to the wealth of technical information published during the year. Each item contains the exact title of the article indexed; the author's name, if given; the name of the periodical in which the article appeared; the volume, number and date of publication; the page numbers and number of figures in the article; and a brief note concisely summarizing the contents of the article. The items are arranged alphabetically under main and sub-headings and carefully cross-indexed for reference purposes.

WASTE IN INDUSTRY. By the Committee of Elimination of Waste in Industry of the Federated American Engineering Societies. Size, 5¾ by 9 inches. Pages, 409. Illustrated by numerous charts and diagrams. Washington, D. C., 1921; Federated American Engineering Societies. New York, 1921: McGraw-Hill Book Company, Inc.

Representing the result of five months of intensive study, carefully planned and rapidly executed by no less than eighty of the foremost engineers of the country and their associates, this report, which embodies the first work undertaken by the Federated American Engineering Societies in rendering public service, reveals facts of incalculable value which may serve as a foundation for an advance in American industry. The report is divided into three parts: (1) giving a summary of detailed reports covering sources and causes of waste and recommendations for elimination of waste, (2) details of the engineers' field reports covering six major industries, of varied character and enormous annual output, and (3) general reports on specific industrial conditions such as unemployment, strikes and lockouts, accidents, health, etc. This report is the first instance of a collective or group endorsement of a general analysis of the sources and causes of waste and recommendations for its elimination. Its benefits will undoubtedly be far reaching as it points the way for locating and eliminating waste in other industries.

The thirtieth annual edition (1922) of Hendrick's Commercial Register, published by S. E. Hendricks Company, Inc., 70 Fifth Avenue, New York, contains 2,300 pages and comprises a thoroughly indexed and carefully classified register of producers, manufacturers, dealers and consumers connected with the electrical, engineering, hardware, iron, mechanical, mill, mining, quarrying, chemical, railroad, steel, architectural, contracting and kindred industries. The products are listed from the raw material to the finished article with the concerns handling them from the producer to the consumer.

Sternwheel Towboat for Mississippi River Service

(Continued from page 371)

capacities ranging from 5,000 to 9,000 barrels, a maximum distance of 150 miles. The oil will be discharged by means of pumping equipment located on the barges. Steam will be furnished from the boilers on the towboat at places where it cannot be obtained from shore. To provide for this, four 1½-inch steam connections have been provided on each side of the boat, two at the forward end of the main deck house and two at the after end of the boilers. When engaged in pumping it is proposed to operate a single battery of boilers.

The cabin, hurricane deck and pilot house are of wooden construction. Panels of 5/16-inch material attached to a light framework are used for the siding and partitions of the cabin to obtain a construction of light weight. A skylight the full length of the cabin provides for the proper ventilation of the quarters.

The hull and machinery plans for this boat were required to meet the approval of the American Bureau of Shipping for river service.

The Economic Efficiency of Merchant Ships

(Continued from page 390)

where $(f' C' - x T - q' F)$
 $F = k l \Delta^{2.3} V^2 L = \text{total fuel}$

and the condition that E is a maximum is $\frac{\partial E}{\partial V} = 0$.

$\therefore [(n V + L) (f' C' - x T - 3 q' F) - n L V (f' C' - x T - q' F)] = 0$
 $\therefore f' C' L - x T L - 3 q' F L - 2 q' F n L V = 0$

Whence

$$\frac{q' F V}{L} \left(\frac{3 L}{V} + 2 n L \right) = f' C' - x T$$

And substituting

$$F = k l \Delta^{2.3} V^2 L$$

$$q' k l \Delta^{2.3} V^3 \left(\frac{3 L}{V} + 2 n L \right) = f' C' - x T$$

the value of V which satisfies this equation will thus be the best speed V_b .
4. Condition for constant "best" speed when f and q vary

$$\frac{\partial V_b}{\partial f} \delta f + \frac{\partial V_b}{\partial q} \delta q = 0$$

where

$$\frac{\partial V_b}{\partial f} = \frac{1}{q' (q' k l \Delta^{2.3} (L + n L V_b) 6 V_b)}$$

$$\frac{\partial V_b}{\partial q} = - \frac{1}{q' (q' k l \Delta^{2.3} (L + n L V_b) 6 V_b)}$$

and substituting

$$\frac{\delta f}{\delta q} = \frac{f' C' - x T}{q C' + r x T}$$

The equation is linear, and the effect of tonnage is to reduce the slope of the curve somewhat.

PERSONALS

A. R. HUNT, general manager of the Seattle plant of the Todd Shipyards Corporation, has been made vice-president.

J. E. MURPHY, former traffic manager of the Emergency Fleet Corporation, has been appointed head of the division of passengers and mails of the Shipping Board.

HARRY W. KENT, hitherto vice-president of the Todd Dry Docks Company of Seattle, has been made president of both the Seattle and Tacoma plants, succeeding C. W. Wiley.

WILLIAM M. TRUSS, formerly with the Bethlehem Shipbuilding Corporation, has been appointed marine sales manager of the Pusey and Jones Company, Wilmington, Del.

ALFRED BUCHT, chief engineer of Sulzer Bros., the Swiss manufacturers of the Busch-Sulzer Diesel engine, is at

present in New York and will visit several other cities in the United States to study our methods of Diesel engine construction before returning to Switzerland.

JOSEPH T. SHEEDY, European manager for the Emergency Fleet Corporation at London, has been made acting director of physical operations, with headquarters at Washington, D. C.

J. E. ANDREWS, who has been assistant to W. B. Keene, traffic manager of the Shipping Board, has been appointed head of the European division at Washington, succeeding F. G. Frieser.

DAVID V. STRATTON, well known in shipping circles and formerly holding an important position with the United States Shipping Board, has succeeded Lloyd Adam Noble with the Morse company.

ROY PARRIS has been appointed resident inspector on the 285-foot car ferry now building for the Missouri and Illinois Railroad at the plant of the Charles Ward Engineering Company, Charleston, W. Va.

HUNTINGTON T. MORSE, former assistant to Joseph T. Sheedy, European manager of the Emergency Fleet Corporation, will succeed Mr. Sheedy in this capacity, still retaining the main office in London.

HARRY BROWN has tendered his resignation as a director and as technical manager of the Bethlehem Shipbuilding Corporation, Ltd., effective June 1. On this date Mr. Brown leaves for an extended vacation.

LLOYD ADAM NOBLE, formerly manager of the New York office of Morse Dry Dock and Repair Company, has resigned his position and is now connected with the firm of W. and A. Fletcher Company, Hoboken, N. J.

C. W. WILEY, former president of the Todd Shipyards Corporation plants at Seattle and Tacoma, Wash., has been made chairman of the Board of Directors and personal representative of William H. Todd on the Pacific coast.

ALLEN PRANGNELL, who has been in the chartering department of S. O. Stray and Company of New York, will succeed W. L. Bull as head of the Mediterranean division of the United States Shipping Board at Washington.

V. J. FREEZE, manager of the traffic department of the United States Shipping Board at Baltimore, will succeed Allan McLane, Jr., as head of the Far East and long voyage trade division of the traffic department at Washington.

W. L. BULL, in charge of the Mediterranean division of the Shipping Board at Washington, D. C., will be transferred to New York to succeed George H. Wells, who recently resigned as head of the European section of the New York office.

F. G. FRIESER, in charge of the European division of the Washington offices of the Emergency Fleet Corporation, has been appointed special assistant to W. B. Keene, traffic manager and will have under his supervision homeward rates and traffic.

LOUIS F. KLEIN of New York has been appointed manager of the inland offices division of the Emergency Fleet Corporation traffic department. Mr. Klein has for many years been connected with railroad traffic work and has in addition made a thorough study of steamship operation.

ALLAN McLANE, JR., who has been head of the Far East and long voyage trade division of the traffic department of the United States Shipping Board Emergency Fleet Corporation in Washington, will shortly leave for England, where he will be connected with Runciman, Ltd., London, agents for the United States Lines.

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other
Notes of Interest in All Branches of the Marine Industry

More Than Sixty-Two Vessels Are in Course of Development as Part of New Construction Program for 1922

**Shipbuilding Outlook for This Year Gives Renewed Cause for
Optimism—Inquiries Becoming More Numerous and
New Contracts Being Signed**

THE construction of over sixty-two vessels as a part of 1922's shipbuilding program, which has been forecasted frequently by MARINE ENGINEERING AND SHIPPING AGE, seems nearer at present than at any time so far during the year. While there are a few ships already contracted for and under construction at the present time there is a steadily increasing number being brought out as "in contemplation" and while it is possible that all of the new ships under consideration will not reach the actual construction stage, there is every reason to believe the majority of the vessels now being planned tentatively will sooner or later be built. As concrete evidence that American shipbuilding is recovering rapidly from the recent depression, a total of sixty-two vessels are listed below of which seven have been definitely contracted for or are already under construction.

The Department of Plant and Structures of the City of New York has awarded a contract for the construction of three turbo-electric ferries to the Staten Island Shipbuilding Company to be built at a total cost of \$1,589,900. The same department is working on plans and specifications for seven Diesel electric ferries for the East River routes.

The signing of contracts for seventeen

electric drive freighters, designed by Theodore D. Wells, naval architect of New York, for ocean and river service for the Central Steamship and Commerce Corporation and also for five Diesel electric cargo boats of special design by R. R. Livingston, naval architect of New York, for the Canal and River Transportation Company, is considered more imminent now than at any time since the work was proposed.

Taken in conjunction with the proposed construction of 10 ships for the New England Oil Refining Company; six for the North Atlantic and Western Steamship Company (Nawasco Line), which is said to be considering motorships; two steamers for the Eastern Steamship Company, plans and specifications for which are now nearing completion; two for the Old Dominion Steamship Company; two for the Red "D" Line; two for the Cleveland and Buffalo Transportation Company; one for the Catskill Evening Line; one for the Savannah Line; two recently contracted for with the Federal Shipbuilding Company by the Merchants' and Miners' Transportation Company; two being built by the Pusey & Jones yard for the Seaboard-Bay Line, the shipbuilding and equipment prospects appear in a brighter light than has been evident in many months.

Indications are that the Admiral Line will request bids for the conversion work from shipyards on both the Atlantic and Pacific coasts.

Specifications For Converting Four Steel Ships Expected Soon Admiral Line Vessels to Be Made Into Motorships, Costing Over Quarter Million

PROSPECTS for the issuance of specifications for the conversion of the steel auxiliaries *Dawnlite*, *Daylite*, *Starlite* and *Moonlite* into motorships, which it is understood will involve the expenditure of a total of close to \$300,000 or over, for the Admiral Line, have improved materially, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE.

The boats are of about 3,000 deadweight tons each and while definite plans have not yet been made it is understood that three of the barges may be equipped with Diesel engines and electric auxiliaries and one equipped with Diesel engines and steam auxiliaries. It is also reported that the auxiliaries are to be taken from certain wooden ships acquired by the Admiral Line on the Pacific Coast.

Contract Is Placed for New 600-Foot Great Lakes Steamship

THE American Shipbuilding Company, of Cleveland, Ohio, has been awarded a contract by the Franklin Steamship Company of Cleveland for the construction of a new steamer at a cost said to be close to \$800,000.

The new steamer will be 600 feet in length, 64 feet beam by 33 feet deep and will be equipped with three Scotch boilers, 14 feet diameter by 11 feet long and a triple expansion engine with cylinders 25½ by 41 by 67 with 42 inch stroke. The vessel is for use on the Great Lakes.

New Ferryboat to Be Built by Staten Island Yard

The Staten Island Shipbuilding Company of Staten Island, New York, has been awarded a contract for the construction of a ferryboat for the Erie Railroad.

It is understood that the new vessel will be a duplicate of the ferryboat *Jamestown*, operated by the same company, which is 206 feet long, 44 feet beam, driven by a two-cylinder compound engine, 18 by 38 by 28, developing 1,200 indicated horsepower, steam being supplied by two single-ended Scotch boilers having a working pressure of 150 pounds of steam. The *Jamestown* was built by the same shipyard in 1907.

Two Steel Quarter Boat Hulls to Be Built for Nashville

Sealed proposals will be received by U. S. Engineer Office, Nashville, Tenn., until 11 A. M., June 26, 1922, for constructing two steel quarter boat hulls. Further information on application.

Bids May Be Asked in Near Future for Fleet of New Special Type Tankers Costing Millions

**Foreign as Well as American Shipyards Will Submit Figures on
Vessels Proposed by New England Oil Refining Company
for South American Service**

BIDS are expected to be asked in the near future for the construction of a number of self-propelled oil carriers possibly from 10 to 15 for the New England Oil Refining Company of 25 Broadway, New York City, which is understood to be contemplating the construction of such boats for service on Maracaibo Lake, South America. If such a program is carried out, from three to six million dollars may be expended in the construction of a special type steel ship. It is also understood that the company will obtain bids from foreign ship-

builders as well as from yards in America.

Details concerning the preparation of final plans and specifications were not available at present, although it is considered likely that the ships will be close to 300 feet in length with the strong possibility that the propelling machinery would consist of triple expansion steam engines with steam supplied by two Scotch boilers. In order to meet requirements, the vessels will probably have a draft of 10 or 11 feet in order to make the passage to and from Maracaibo Lake.

Plans Being Pushed for Seven Diesel-Electric Ferries to Be Built For East River Service, New York

**Final Specifications Will Provide for Steel Boat 175 Feet Long,
Driven by Two 400-Horsepower Diesel Engines—Hope
to Ask for Bids Before Summer**

PLANs and specifications for the construction of a total of seven Diesel electric ferryboats by the Department of Plant and Structures of the City of New York, for service in the East River, are well under way, according to an announcement by Commissioner Grover A. Whalen. The bids for these vessels will probably be received within a few weeks and it is estimated that the boats will cost a total of approximately \$1,540,000.

With regard to the construction and equipment of these ferries, Commissioner Whalen said:

"We have designed a boat 175 feet long over all with a breadth of 64 feet, having ascertained by actual experience that this is the best size for handling in congested waters of the East River with its peculiar currents and eddies.

CONSTRUCTION

"We propose to build the boats of steel, with five watertight compartments in the hull, with three vehicle gangways and cabins for passengers on the overhang on each side. By abandoning the old steam engine type and using screw propellers instead of side wheels we can have the room for the third runway.

PROPULSION

"We are considering installing in each boat two 400-horsepower engines of the

Diesel type. Specifications are being prepared that permit of the widest possible competition, under which engines of the solid fuel injection type or of the high pressure air atomized type may be used.

"There are several makes of engines of each of these types that have demonstrated their dependability, such as Ingersoll-Rand, Worthington and De LaVergne of the former type, and the Werkspoor, Winton, New London, McIntosh & Seymour and Busch-Sulzer of the latter type.

"A generator will be direct connected to each engine producing the electric current to propel the boat at a speed of 12 miles an hour and to operate the auxiliary machinery.

CONTROL.

"It is designed to install three master controllers, one in each pilot house and one in the engine room, so that the pilot can control the starting, stopping and reversing and regulate the speed, or the control can be taken over by the engineer and operated in response to usual ship telegraph and bell signals.

"It is planned to provide service gravity tanks to feed the fuel oil to the engines and storage tanks that will carry ten days' supply. The same fuel will be used for the small steam boiler that will provide heat in winter.

"The preliminary studies have been under way for six months and we are now at work on the actual plans and specifications, hoping to advertise contracts for seven ferryboats of this type before summer."

Robins Yard of Todd Corporation Low Bidder for Huron Reconditioning

The Robins Dry Dock & Repair Company of the Todd Shipyards Corporation, with a price of \$179,000, submitted the lowest tender for reconditioning the steamship *Huron* at the opening of bids by the Shipping Board at 45 Broadway, New York City, on May 12. The prices submitted were as follows:

Robins Dry Dock & Repair Co....	\$179,000
Bethlehem Shipbuilding Corp.	183,162
Morse Dry Dock & Repair Co.....	190,900
Sun Shipbuilding Co.	258,578

Fuel Oil Burning Equipment for Army Dredge

Fuel oil burning equipment has been ordered for installation on a United States Army dredge located at Porto Rico. The equipment selected is the Bethlehem (Dahl) mechanical system built by the Bethlehem Shipbuilding Corporation, Ltd., and the installation is being made at Porto Rico. The order was placed through the office of the Second District, United States Army Engineers, New York.

Buxton Line Will Replace Vessels Lost In Fire and Crash

THE Buxton Steamship Company of Norfolk, Va., on April 13, lost in a fire at Berkly the 115-foot oil burning ocean tug *Buxton*, the 216-foot side wheel excursion passenger steamer *Rosedale*, the 135-foot freight steamer *Martha Stevens* and the 71-foot auxiliary twin-screw passenger boat *Watch Hill*.

On April 21 their 176-foot oil burning freight steamer *Brewster* was rammed and sunk by the New York-Richmond Line steamer *Lake Stirling* while en route from Richmond to Norfolk with cargo. Chief Engineer, C. W. Hussey was lost with the *Brewster*. This steamer had recently been overhauled, having new boilers and other new equipment installed.

Disregarding all of these losses, the Buxton Line is reported to be going right ahead, having faith in the future of Norfolk as a port city. It is stated that the company intends to replace all of these ships at some future date but is in the market for a ship to replace the *Brewster* at once, as this boat is needed on the Norfolk-Richmond run.

Fireboat Planned For New Orleans, La., Is To Be Oil Burner

**Will Be Driven by Reciprocating
Engines and Is to Have Com-
plete Fire Fighting Equip-
ment—Bids June 29**

THE Board of Commissioners of the Port of New Orleans are advertising for bids on the construction and delivery of a steel screw fireboat 138 feet 6 inches long, 29 feet beam and 15 feet 6 inches deep. She will be fitted with compound engines 20½ inches and 46 inch diameters of cylinders and 28-inch stroke.

There will be four turbine driven fire pumps, of a combined capacity of 10,000 gallons per minute at a pressure of 200 pounds per square inch at the pumps. Four 6-inch monitor nozzles will be installed, one on a high tower aft of the main engine hatch, two on platforms amidships, and one on the pilot house. Sixteen hose connections will be provided on the turrets under the midship monitors, and swivel nozzles are fitted on the main rail at intervals. Three steel hose reels on deck will carry about 2,500 feet of hose. There is to be a complete outfit of all modern appliances for fire fighting.

There will be two watertube boilers for 225 pounds working pressure, fitted to burn fuel oil. All auxiliaries are independent. The vessel will be built for classification, but far in excess of all rules. When in action, she will deliver over fifty tons of water per minute. She was designed by and will be built under the supervision of Cornell and Matthews, naval architects and engineers, Philadelphia. Bids will be opened in New Orleans, June 29, 1922, and it is believed the vessel will cost close to \$250,000.

Standard Oil May Convert Steam Tankers to Motorships

According to latest reports, the Standard Oil Company of New Jersey is planning the conversion of several of its tankers from steamships into motorships. It is understood that propulsion equipment developing close to 3,000 horsepower, driving twin screws, may be installed in each ship converted. Further details as to the number of ships which may be involved, or the amount of money which may be expended, were not available at this time.

Newport News Yard Gets Tanker Libby Repairs

The contract for repairs to the Standard Oil tanker *W. H. Libby*, consisting chiefly of bottom damage effecting 35 plates, has been awarded to the Newport News Shipbuilding and Dry Dock Company. The bids submitted for the work were as follows:

Newport News Shipbuilding & Dry Dock Co.	\$34,615
Robins Dry Dock & Repair Co.....	37,700
Staten Island Shipbuilding Co.....	38,445
Morse Dry Dock and Repair Co....	43,882



Third Annual Dinner of the Marine Committee of the American Institute of Electrical Engineers at the Hotel Astor, New York, on April 28

Marine Committee of American Institute of Electrical Engineers Holds Third Annual Dinner

Set of Standardization Rules Prepared on Good Engineering Practice Covering Fire Protection and Marine Construction Requirements

THE third annual dinner of the Marine Committee of the American Institute of Electrical Engineers was held at the Hotel Astor on April 28, 1922. This committee was originally appointed by the American Institute of Electrical Engineers in 1913 because of the differences existing between the requirements of various classification societies and insurance companies in regard to electrical installations on shipboard and the lack of any accepted standard engineering practice for marine installations.

Besides arranging for papers to be read at the meetings of the Institute to increase the interest of electrical engineers in marine problems, the committee took up the preparation of standardized rules which would represent good engineering practice and which might be accepted by the classification societies. As a result, a set of rules was prepared covering two important divisions, namely: fire protection requirements and marine construction requirements. These rules were adopted by the committee of the American Bureau of Shipping and were published as Section 37 of the Rules for Building and Classing Vessels issued by that Bureau.

As the first edition of the rules did not cover the entire field of the use of electricity on shipboard, the Marine Committee was continued and a more nearly complete set of marine rules has now been issued which in the arrangement and scope conform to a similar set of regulations issued by the

Institution of Electrical Engineers in England. The committee is now undertaking a work of far-reaching importance with a view to establishing approved standards in the application of electricity to merchant ships.

The members of the committee are as follows:

Arthur Parker, New York Shipbuilding Corporation, Camden, N. J., chairman; L. C. Brooks, Bethlehem Shipbuilding Corporation, Quincy, Mass., secretary; J. B. Bassett, General Electric Company, New York; R. A. Beekman, General Electric Company, Schenectady, N. Y.; Eskil Berg, General Electric Company, Schenectady, N. Y.; Maxwell W. Day, General Electric Company, Schenectady, N. Y.; David D. Faris, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; E. G. Gallagher, Lake Torpedo Boat Company, Bridgeport, Conn.; H. Franklin Harvey, Jr., Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; William Hetherington, Jr., Cutler-Hammer Manufacturing Company, New York; H. L. Hibbard, Cutler-Hammer Manufacturing Company, New York; J. S. Isdale, New York Harbor Dry Docks Corporation, New York; William F. James, Westinghouse Electric & Manufacturing Company, Philadelphia, Pa.; Commander C. A. Jones, U. S. N.; Commander C. S. McDowell, U. S. N.; W. F. Meschenmoser, Russell & Stoll Company, New York; I. H. Osborne, Federal Shipbuilding Company, Newark, N. J.; G. A. Pierce, Jr., William Cramp & Sons Ship and Engine Building Company, Philadelphia, Pa.; Commander S. M. Robinson, U. S. N.; H. M. Southgate, Westinghouse Electric & Manufacturing Company, Washington, D. C.; W. E. Thau, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; F. P. Townsend, Kindred Appliances Company, Newark, N. J.; A. E. Waller, Ward Leonard Electric Company, Mt. Vernon, N. Y.; and F. W. Wood, Charles Cory & Sons, Inc., New York.

Federal Shipbuilding Company Low Bidder for Poznan Reconditioning

THE Federal Shipbuilding Company was low bidder for reconditioning the steamship *Poznan* of the Luckenbach Line at the opening of tenders at the Luckenbach pier, Brooklyn, on May 20. The prices submitted were as follows:

Federal Shipbuilding Co. \$207,000
Robins Dry Dock & Repair Co. 224,940

Sun Shipbuilding Co. 229,076
Tietjen & Lang 257,620
Bethlehem Shipbuilding Corp. 272,253
New York Harbor Dry Dock Co. 345,000
Newport News Shipbuilding & Dry Dock Co. 373,000
W. & A. Fletcher Co. 383,000

The work covered by the specifications included the reconditioning of the vessel for certificate of local inspectors of the Panama Canal, Suez Canal and the American Bureau of Shipping. The principal work is to open up all the main engines, overhaul them, remove the boilers, replace with new boilers furnished by the owners, recondition the rig-

Atlantic Coast Shipbuilders' Association Holds Annual Convention

THE annual meeting of the Atlantic Coast Shipbuilders' Association was held in Philadelphia on Monday, May 8, 1922. Representatives of every shipbuilding district in the East attended the meeting and the list of speakers included W. Averill Harriman, chairman of the American Ship and Commerce Corporation; Honorable George Earle Chamberlain, Commissioner of the United States Shipping Board, and Admiral Louis McCoy Noltton, commandant of the Philadelphia Navy Yard, who spoke with considerable significance regarding a permanent future for shipbuilding as a successful American industry.

It was emphatically stated that America's future on the high seas depends for the most part on liner service and attention was called to the fact that this country is at present greatly lacking in vessels of this class and that every effort should be made to obtain ships that can compete successfully with countries that are our chief rivals in foreign trade.

The following officers were re-elected for the ensuing year: President J. L. Ackerson; vice-president, George H. Bates; treasurer, J. Harry Mull; secretary, Clarence Samuel King.

ging, recondition the fire fighting system, removing the gun foundations, relocating the king posts, installing a gyro-compass, renovating the cargo pipe system on deck, preparing the tanks for fuel oil including new separate tanks, installing the Peabody oil-burning system complete, reconditioning the wooden decks, overhauling all the communicating systems, reconditioning the fire and floor plates and installation of the Rand fuel oil heating system. The ship is to be renamed the *Frederick Luckenbach*.

Thatcher Propeller Company to Expand Plant

The Thatcher Propeller and Foundry Corporation, Albany, N. Y., is offering for public subscription approximately \$250,000 of its new issue of 8 percent cumulative preferred stock and common stock. The object of this issue is to raise capital to permit the purchase of additional machinery, electric travelling cranes, a manganese bronze furnace, the latest type of steel furnace and also raw materials.

Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Fireboat, New Orleans, La.—Board of Commissioners of Port of New Orleans will open bids June 29 for the construction and delivery of steel screw fireboat, 138 feet 6 inches long, 29 feet beam and 15 feet 6 inches deep. To be fitted with compound engines 20½ inches and 46 inch diameter of cylinders and 28-inch stroke.

Steamship to Be Fitted for Refrigeration.—Plans and specifications for conversion of steamship San Lorenzo, of New York and Porto Rico Line, to carry citrus fruits from West Indies, expected to be completed soon. Work will probably cost close to \$100,000.

Repair Contract, Staten Island, N. Y.—Staten Island Shipbuilding Company awarded contract for hull work on pilot boat New York, at opening of bids by United New York-Sandy Hook Pilots' Benevolent Association, Whitehall St., New York, on May 11.

Overhauling of Tanker, New York.—New York Harbor Dry Dock Company awarded contract for general overhauling of hull and machinery of tanker H. C. Bedford, of Standard Oil Company of New Jersey, at opening of bids on May 10. Price \$8,021.

Miscellaneous Repairs, Chester, Pa.—W. M. Irish, tanker of Atlantic Refining Company, was dry-docked for miscellaneous repairs at Sun yards.

Reconditioning of Steamer, Oakland, Cal.—Repairs amounting to \$44,900 made to Pacific Mail liner, Wolverine State, by Moore yards, Oakland, Cal., including installation of steerage accommodations for 219 passengers and changing of the engineers' quarters. Vessel will engage in passenger and freight-carrying trade from San Francisco to Manila and Hong-Kong via Honolulu with her sister ship, the Croile State.

Danish Steamer Repaired, Newport News, Va.—All necessary repairs to Danish ship Anna Moersk made by Newport News Shipbuilding and Dry Dock Company.

Repairs to Brazilian Steamship, Newport News, Va.—Large Brazilian steamer Camamu was repaired at Newport News shipyard. Raleigh-Smokeless Fuel Company, agents for vessel.

Steamer Dry Docked, Galveston, Texas.—The Mundella drydocked at Galveston, Texas, and underwent repairs caused by damages sustained recently at Sabine when rammed by Shipping Board tanker Mevania.

Steamship at Naval Plant, Seattle, Wash. The Wenatchee, Shipping Board's big transpacific liner, at Bremerton Navy Yard, Seattle, Wash., for dry-docking, inspection and overhauling.

Schooner Repairs, Boothbay, Me.—Schooner Margaret Thomas, undergoing extensive repairs at Boothbay Harbor, which will take several weeks to complete.

New Ship Propeller.—The Grace Liner Colusa shifted to San Francisco, Cal., for drydocking and inspection and installed a new propeller.

Steamer Burns, Havana, Ill. The 2,500-ton Mississippi River steamer Majestic burned at Havana, Ill. Steamer left Peoria for Havana a few days previous to its destruction.

Dredge Dry Docked, Oregon.—Government dredge Colonel P. S. Michie drydocked for repairs to her propeller and upon completion returned to her station at Coos Bay.

Norwegian Steamship Dry Docked, Philadelphia, Pa.—First vessel consigned to B. H. Sobelman & Company for new Baltic service from Philadelphia, Norwegian steamship Rio Grande, drydocked at Cramp's shipyard, Philadelphia, for bottom painting, before going into berth at Pier C, Richmond.

Miscellaneous Repairs, Chester, Pa.—J. C. Donnell, tanker of Atlantic Refining Company, dry-docked at Sun Shipyard for miscellaneous repairs.

General Overhauling of Tug.—The boarding tug Governor Pennypacker, used by the health officers at Marcus Hook, was overhauled at Philadelphia.

Eleven Ship Repair Contracts, Hoboken, N. J.—Over eleven repair contracts were awarded to the W. & A. Fletcher Company, Hoboken, New Jersey, during the week ending May 13. Work provided for both hull and engine repairs and reached a total in excess of \$42,000.

Tug on Marine Railway, Philadelphia, Pa.—Tug Henry P. Mills, of Delaware River Towing Company, recently went to Marine Railway at Philadelphia Ship Repair Company's yards. Her machinery was disabled.

Dredge Repaired, Portland, Ore.—The Colonel P. S. Michie went to Portland, Ore., for repairs.

Extensive Steamer Repairs, Brooklyn, N. Y.—Contract for reconditioning steamship Princess Matoka awarded Morse Dry Dock & Repair Company, Brooklyn, N. Y.

Specifications for Conversion.—Issuance of specifications for conversion of steel auxiliaries Dawnlite, Daylite, Starlite and Moonlite into motorships, understood to involve a total of close to \$300,000 or over, for Admiral Line, expected soon.

Bids for Tankers, N. Y.—Bids are expected to be asked in near future for construction of a number of self-propelled oil carriers, possibly from 10 to 15, for New England Oil Refining Company, of 25 Broadway, New York City, understood to be contemplated for service on Maracabo Lake, South America. If such a program is carried out, from three to six million dollars may be expended.

Boat Hulls, Nashville, Tenn.—Sealed proposals will be received by U. S. Engineer Office, Nashville, Tenn., until 11 A. M., June 26, 1922, for constructing two steel quarter boat hulls. Further information on application.

Contract for Steamship, Cleveland, O.—American Shipbuilding Company, Cleveland, Ohio, awarded contract by Franklin Steamship Company, Cleveland, for construction of new steamer at cost said to be close to \$800,000. New steamer to be 600 feet long, 64 feet beam by 33 feet deep, and equipped with three Scotch boilers, 14 feet diameter by 11 feet long and a triple expansion engine with cylinders 25½ by 41 by 67 with 42 inch stroke. Vessel for use on Great Lakes.

Ship at Southern Yard.—British steamship Balsa went to Southern Shipyard, having been bought and floated by Captain Griffin, of Norfolk, after being stranded.

Ships at Colonna Shipyards, Norfolk, Va.—Ships in Colonna yard recently were: Barkentines State of Rumont, State of New Orleans and Mercatata, for general repairs to hull and auxiliary machinery; United States Shipping Board steamer American Press, for painting, scraping and bottom repairs; Shipping Board steamer Tonally, for survey and general repairs; steamship Mazama, repairs to machinery; tug Eastern, general repairs; and fishing steamers Rappahanock, Peconic, E. W. Edwards, M. M. Davis, East Hampton, Dolphin, Northumberland, B. H. B. Hubbard, A. Brooke Taylor, G. S. Allen, D. K. Phillips and the Steven W. McKeever, all for seasonal overhauling. Yard repaired a number of ear floats for N. Y. P. & N. Railroad.

Tanker for Repairs, Brooklyn, N. Y.—Contract for repairs to Standard Oil tanker H. M. Flagler awarded to Robins Dry Dock & Repair Company of Todd Shipyards Corporation at \$12,495.

Contract Awarded, Newport News, Va.—Contract for repairs to Standard Oil tanker W. H. Libby, consisting chiefly of bottom damage effecting 35 plates, awarded to Newport News Shipbuilding and Dry Dock Company at \$31,615.

Steamship Overhauled, San Francisco, Cal.—The

Valdez, out of commission all winter, shifted to Heffernan Dry Dock, San Francisco, Cal., for overhauling preparatory to being placed in commission.

Low Bidder for Reconditioning, Brooklyn, N. Y.—Robins Dry Dock & Repair Company of Todd Shipyards Corporation, with price of \$179,000, submitted lowest tender for reconditioning steamship Huron at opening of bids by Shipping Board at 45 Broadway, New York City.

Construction of Scows, New York.—Plans and specifications issued and bids will be received by Board of Purchase of City of New York in Room 526, Municipal Building, Borough of Manhattan, from 9 to 10:30 A. M., Monday, June 5, for furnishing to Street Cleaning Department twelve side-dumping scows at cost estimated at close to \$250,000.

Contract for Three Ferries, Staten Island, N. Y.—Contract for three steel screw electric-driven ferries awarded by Commissioner Grover A. Whalen, of the Department of Plant and Structures, New York, to Staten Island Shipbuilding Company at total cost of \$1,589,900.

Five Cargo Boats.—A contract for construction of five Diesel electric cargo boats for Canal & River Transportation Company, New York, and which it is understood will involve expenditure of over \$500,000, expected to be placed in near future.

Conversion to Motorships.—Standard Oil Company of New Jersey planning conversion of several of its tankers from steamships into motorships. It is understood that propulsion equipment developing close to 3,000 horsepower, driving twin screws, may be installed in each ship converted.

Steamer Refitted, Seattle, Wash.—Steamship Brookdale, after lying idle in Lake Union a year, has been repaired and refitted for cannery trade at Eagle Harbor plant of the Winslow Marine Railway & Ship Repairing Company, Seattle, Washington. She is one of the largest wooden carriers built for the Shipping Board, being 272 feet long, 49 feet beam, and of 4,200 deadweight tons.

Wooden Steamer Repaired, New Orleans, La.—American steamer Nika, one of wooden vessels built at Moss Point, Mississippi, by Hodge Shipbuilding Company, during the war and completed the latter part of 1919, repaired at Henderson Dry Docks. She was recently bought by F. M. Starks of San Francisco, and entered service at Mobile, taking cargo to Pacific Coast.

Repairs to Steamer, Newport News, Va.—British steamer Madras City repaired at Newport News Shipbuilding & Dry Dock Company's yard.

Renewed Activity, Gloucester, Mass.—Cape Ann Anchor Company, of Gloucester, Mass., has started plant on one-third normal capacity basis after idleness of over five months. A. P. Stoddard & Company, engineers and machinists of Gloucester, Mass., report increasing number of inquiries, also larger volume of business. This plant is making hoisting winches and steering gear for small and medium-sized vessels and are equipped to handle fair-sized marine engine and motor work.

Miscellaneous Repairs, Chester, Pa.—Steamship Ontario, of Merchants & Miners' Transportation Company, drydocked at Sun Shipyard for miscellaneous repairs.

Contracts Awarded, Brooklyn, N. Y.—Two contracts, probably involving total expenditure of close to \$175,000, awarded Robins Plant of Todd Shipyards Corporation, Brooklyn, New York. The contracts included reconditioning of the steamships Mexico and City of Savannah.

Construction Contracts, Pittsburgh, Pa.—Dravo Contracting Company, Pittsburgh, Pa., awarded contract by United States District Engineer, Army Building, New York, for construction of steel oil barge for service in New York waters and water barge for service at Philadelphia, with bid of \$41,200.

PORT IMPROVEMENTS

Contract Awarded, Seattle, Wash.—Colby Steel & Engineering Company, 416 Central Building, Seattle, Wash., awarded contract by Port of Grays Harbor Commissioner, 206 East Wiskah street, for one 5-ton crane, 95-foot hammerhead crane.

Pier, Cape May, N. J.—W. C. Hunt, 1220 Vine street, Philadelphia, building timber pile pier at Cape May, N. J. Price, \$90,000 (timber theatre included). A. J. Sauer, Dencla Building, Philadelphia, engineer.

Dredging Contract, New York.—A contract has been signed between the Mexican Government and American Dredging Company of New York, for deepening and otherwise improving the port of Frontera, in the State of Tabasco, one of the wealthiest ports of the Republic of Mexico.

Grain Elevator, Norfolk, Va.—The contract for construction of Norfolk's new municipal grain elevator awarded to A. M. Crain & Company, of Chicago, whose bid of \$639,900 was lowest of six offers, when the time of completion is taken into consideration.

Plans to Deepen Harbor, Gulfport, Miss.—Major Earl North, government engineer in charge of Gulfport, Miss., district, port commissioners of the city of Gulfport, City Attorney Heels and Mayor Haldon of Gulfport, held important conference recently relative to contemplated improvements of Gulfport harbor and channel. Funds available for dredging this year amount to \$175,000, sufficient to dredge channel to 23 feet at mean low tide, making it possible for vessels to go out drawing twenty-five feet. Dredge Pascagoula has commenced work and will be used to deepen channel to municipal pier to make it available to vessels drawing twenty feet. Deepening water for Gulfport, it is believed, will increase shipping.

Piers and Docks, Cleveland, O.—Detroit & Cleveland Navigation Company, foot of East 9th street, Cleveland, O., plans one-story concrete piers and docks, 300 by 700 feet, at \$400,000. D. C. McIntyre, manager. Private plans.

Terminal Construction, Memphis, Tenn.—City of Memphis, Tenn., Rowlett Payne, mayor, and Federal Government to construct \$500,000 terminals; let contract to R. W. E. Thompson, Earle, Ark., to build 4 concrete floating docks equipped with steel sheds and electric cranes, 1,600 feet tramway extending into the river parallel with the bank. Storage yards and sheds provide facilities for loading and unloading of freight, etc.

Dredging Contract Award, New York.—Port Commissioner of Norfolk, Va., let contract to Atlantic Gulf & Pacific Company, Park Row Building, New York City, for dredging and filling 750,000 cubic yards at Sewells Point, in connection with proposed city terminals.

Contract for Harbor Work, St. Petersburg, Fla.—City let contract to St. Petersburg Concrete Construction Co., 1141 1st street, to construct concrete slab sea wall and dock, part of Bayboro harbor improvements, costing \$50,000. B. C. Tarrin, City Engineer.

Harbor Improvements, Miami, Fla.—Bowers Southern Dredging Company, Galveston, Texas, awarded contract by city commissioners to dredge turning basin and slip between docks, \$99,000.

Dam, Poplar Bluff, Ark.—Butler County Commissioners contemplating building flood detention dam; approximate cost, \$8,000,000.

Dock System, Ohio River.—The Inland Waterways Company formed to build extensive system of docks on Ohio River at Louisville, Kentucky, and Jeffersonville, Indiana. Work opens vast possibilities and is to be started this summer. Interstate Public Service Company to construct the docking system on Indiana side of river and will have charge of operations there.

Development of Oakland Harbor, Cal.—U. S. War Department approved plans for development of Oakland, California, on eastern shore of San Francisco Bay. Estimated expenditure, \$1,371,405, part of cost to be borne by City of Oakland and part by Federal Government.

NEW INCORPORATIONS

Los Vecinos Company, Ltd., capital \$5,000,000, to operate passenger and freight ships between Los Angeles and Mexican and Central American ports, incorporated in California as a common law trust.

President and general manager, John C. Allen; vice-president and assistant general manager, Joseph McMillan; vice-president and secretary-treasurer, E. W. Eldney.

The Western Transportation Company, Wilmington, Delaware, capital \$100,000, incorporated at Dover, Delaware, to do business in steamships; Corporation Trust Company of America, at Wilmington, registrars.

The Pennsylvania Shipyards, Wilmington, Delaware, capital \$300,000, incorporated at Dover, Delaware.

Delta Export Lumber Corporation, capital \$500,000, incorporated at Dover, Delaware, to do an export and import lumber business; incorporators, R. L. Jurden, James E. Stark, and R. G. Hackney, of Memphis, Tenn.

Allen-Jensen Company, Tampa, Florida, organized by Randolph P. Allen, Carston A. Jonsen and Axel Pederson; reported to have taken over complete equipment of Daniels Shipyards; plan to build either wood or steel ships of any tonnage.

Union Marine Service Corporation, Fairfield, Maryland, capital \$30,000, chartered by Rupert C. Cowles, Charles Hoffman and Frank J. Whelan; to repair ships.

Maryland Dry Dock Company, Fairfield, Maryland, capital \$2,000,000, incorporated with John A. Spillman, president; George E. Probst, secretary-treasurer; successors to Globe Shipbuilding & Dry Dock Company; to build ships.

Marine Dispatch Steamship Line, Title Building, Baltimore, Maryland, capital \$10,000. Frank H. Ober, Joel W. Massie and Charles B. Hoffman; incorporators.

Dunn-O'Neill Transportation Company, Inc., Clarendon, Va.; Robert O'Neill, president; Harold E. Dunn, secretary.

Kenova Wharf & Ferry Company, Kenova, West Virginia. Organized to establish steam ferry between Kenova, West Virginia, and North Kenova, Ohio.

Inland Waterways Company, Indianapolis, Indiana, build extensive system of docks on the Ohio River at Louisville, Ky., and Jeffersonville, Ind.

Wilbur F. Spice & Co., steamship lines, 300 Chamber of Commerce Building, Baltimore, Maryland, capital \$50,000; Robert C. Herd, Henry R. Guttner and Hester R. Spice; incorporators.

"Chilian Lloyd," Valparaiso, Chile, capital \$2,000,000, reported to have been founded for the purpose of providing a regular connection with the principal ports of the West Coast. Most of the capital, it is stated, has been subscribed by an important group of merchants who will ship their goods by the new line. The service will be carried on by two 1,800-ton steamers at the outset, which, besides cargo, will be able to carry a small number of passengers.

Argonaut Steamship Company, New York, incorporated under laws of the State of New York, capital \$250,000. A. H. Ely, E. P. Collins and H. P. Elliott are reported as incorporators.

FOREIGN ACTIVITIES

Proposed Ports for China.—Negotiations being carried with view to opening Whampoa, China, as commercial port, and plans prepared for harbor capable of accommodating ocean-going vessels. A company has been promoted for purpose of developing Tsingingchow, with a capital of \$3,000,000. The company applied to Government for additional \$200,000 necessary to finance the undertaking.

New Port of Call, Germany.—The Kroonland, Red Star liner, is to call at Cuxhaven to land passengers. This is first occasion for old Antwerp service to run into this German port.

New Dry Dock, South Wales, England.—Work in connection with construction of new drydock at Swansea by Sir John Jackson, Limited, for Palmers (Swansea) Dry Dock Company is progressing. The Mayor of Swansea made an appeal to Sir John Jackson to give as much work as possible to local men, stating that in anticipation of work non-residents were pouring into the district from all over the country.

Tanker Launched, Belfast.—Messrs. Workman, Clark and Company launched at Belfast the steamer British Engineer, 410 feet long, 6,390 tons, for British Tanker Company's Anglo-Persian oil service. There are ten holds for carriage of oil cargoes, with additional capacity for light oils in tanks built in the 'tween decks.

Port Developments, Argentine.—Report favorable to project of reconstructing wharves and dock at Port of La Plata, Argentina, to accommodate ships drawing up to 30 feet has been made by Communications and Transport Committee of Chamber of Deputies. The scheme is estimated to involve expenditure of over \$4,000,000, of which half is included in budget for 1921 and half in that of 1922. New port works at Buenos Aires, being carried out by Messrs. C. H. Walker & Company, under revised contract necessitated by the war, are proceeding satisfactorily. An expenditure of \$5,000,000 has been recommended for provision of warehouses and other storage accommodation equipped with electric cranes and cargo handling appliances. Dredging operations are being actively pursued in order to facilitate access to new port, which will receive vessels drawing up to 33 feet.

New Italian Motorships.—Two motorships, one an oil tanker, are being built by Ansaldo San Giorgio for the Roma Steamship Company. Tanker to be of about 8,500 tons deadweight, driven by two Ansaldo two-cycle Diesel engines of 1,100 brake horsepower each, giving speed of 10½ knots on fuel consumption of about 11 tons daily. Steam to be utilized for driving cargo pumps and other auxiliary machinery, although compressed air will be employed for operating steering gear and minor engine-room auxiliaries when the vessel is at sea. The other ship, to be named Faleria, will be of 8,100 tons deadweight, 377 by 51.9 by 24.6 feet draft. Propelling machinery to be similar to that in the ship previously mentioned, and a speed of about 10½ knots is anticipated on an equivalent fuel consumption.

Shipbuilding at Amble, Northumberland Coast.—The Amble Shipbuilding Company, subsidiary of Palmers Iron and Steel Shipbuilding Company, Ltd., Jarrow, has secured an order for building 28 double decked motor boats for service on the Thames. Boats are to order of Thames Motor Boat Passenger Services, Ltd., new company being formed to develop passenger traffic on Thames between Woolwich and probably work higher reaches of the river. They will average 100 feet long, 16 feet beam, and carry 200 passengers each. To be of twin screw type, with Thornycroft engines.

Pittsburgh's Maiden Trip, England.—The new White Star Liner Pittsburgh, 16,600 tons, is due to commence her maiden trip in the company's service from Liverpool and Queenstown to Boston and Philadelphia on June 6. The Pittsburgh is a two-class boat of the Regina type. The ship is equipped with all modern conveniences and luxuries, and her machinery, which is of most up-to-date character, will include six double-ended multitubular cylindrical boilers, total weight being over 650 tons. There are 36 furnaces and 4,764 smoke tubes. The Pittsburgh will work in conjunction with the popular Haverford, a twin screw vessel of 11,635 tons gross register.

Bordeaux and St. Nazaire Improvements, France.—Port authorities at Bordeaux and St. Nazaire planning extensive installation schemes. With approval of Midi and Orleans railways, which are interested, a bill will shortly be tabled in the Chamber to authorize construction of an outer port, to be termed the Port de Verdon, at Bordeaux. St. Nazaire authorities have decided to deepen harbor throughout, building in lower roundstead a new 500-meter wharf, where vessels of 39 foot draft may berth. The mole at Port de Verdon is to be 300 meters long, capable of taking three or four liners at a time. Two new docks are also to be built at St. Nazaire when circumstances make it advisable, one for shipbuilders and the other for incoming liners. Latter to be 800 meters long and 400 meters wide.

Tokio Harbor Developments.—Municipal authorities of Tokio have decided to expend sum of 350,000,000 yen on harbor improvement works.

New Pier at Port Melbourne, Australia.—Harbor Trust Commissioners have adopted proposal to construct a new pier at Port Melbourne, to relieve pressure of traffic on existing pier.

Launching of the Durenda, Port Glasgow, Scotland.—The second motor vessel built to the order of the British India Steam Navigation Company, the Durenda, was launched from the yard of Robert Duncan and Company, Port Glasgow, Scotland, recently. The length is 465 feet over all, beam 58 feet, and the length brake power 450 feet. Two eight-cylinder North British Diesel engines will be installed, with cylinders 26½ inches diameter and 47 inch stroke, having a speed of revolution of 96 per minute. Electric power will be used throughout for auxiliary purposes. Another vessel is being built for the British India Steam Navigation Company with the same dimensions as the Durenda.

BUSINESS NOTES

Metal & Thermit Corporation, New York, announces the removal of its Pittsburgh branch office from 1427 Western avenue, to 801-807 Hillsboro street, Corliss Station, Pittsburgh, Pa.

L. B. Pickering, of Newport News, Va., has been sent to the New York office of the Newport News Shipbuilding and Dry Dock Company to represent the shipyard's repair department there. It is the first time the shipyard has established such an office in New York. Mr. Pickering has been with the shipyard many years. He is a United States Naval Academy man.

The Shipping Board has established seven inland office divisions with Louis F. Klein of New York as manager. One of the most important offices will be in Chicago. The other interior offices will be at Detroit, Minneapolis, St. Louis, Memphis, Kansas City and Cincinnati.

STEAMSHIP INTERESTS

Announcement has been made by the M. H. Tracy & Company, New York, of a fortnightly intercoastal service, the first sailing to be June 1. It is reported that the company may include in their list of direct ports of call on the Pacific coast, those ports recently eliminated by the westbound conference, among which were San Diego and Tacoma.

The Ward Line inaugurated on May 18 a passenger and freight service between Tampico, Vera Cruz and New Orleans. Every two weeks the *Yucatan* will leave New Orleans. The ship will go to Tampico via Vera Cruz but will go direct from Tampico to New Orleans on the return trip.

Two additional river steamers have been purchased by the Buxton Line, Norfolk, Va., and service between Norfolk and Richmond will be put on a daily basis. There has been no daily service on the James River since the former Old Dominion Steamship Company abandoned the line two years ago.

Announcement has been made by the Isthmian Steamship Lines, Inc., New York, of a regular service between New York and ports of South and East Africa, beginning with the steamer *Birmingham City* sailing on June 20 for Cape Town, Algoa Bay, East London, Port Natal, Delagoa Bay and Beira.

Starting with the sailing of the steamer *Taiyo Maru* May 11, the Toyo Kisen Kaisha inaugurated a new route for its steamers from San Francisco to the Orient by way of Formosa, allowing the passengers a day stop over at this port. The company's freight steamers making tours of the world will make calls at Australian ports hereafter, thus inaugurating the first Japanese service route via Australia.

With the sailing of the steamship *El Mar*, formerly of the Morgan Line, from pier 27, North River, New York, a direct freight service between Portland, Maine, and New York was resumed May 22. The Portland and New York Steamship Company expects to maintain bi-weekly sailings from each port. The company is offering freight rates lower than those for rail hauls between the two ports. Other ships will be added as the cargoes offered warrant the increase.

General Pacific coast agents for the American-Hawaiian Line, New York, have announced that the westbound sailings of the steamers of the line will be increased from a fourteen-day schedule to a weekly basis.

With the steamer *North Star* inaugurating a system of lakes-rail-ocean communication, the northwest was brought nearer to Europe with the arrival of the ship at Chicago. The vessel is one of 24 steamers connecting Buffalo, Erie and Detroit with the terminals of western roads at the west of the lakes. The fleet will accept export bills of lading from any interior points with railway connection to Chicago for shipment to Liverpool, and other European ports via the Lehigh railway from the east ports of the lakes to New York and ocean steamship lines the rest of the way. Opening of the lakes-rail-ocean traffic has made possible rates ranging less than corresponding rail rates for shipments to or from the interior, according to company officials.

The New York & Porto Rico Steamship Line has reduced its passenger fares between New York and ports of Porto Rico. The company's sixteen-day cruise around the island, which for years has been a popular vacation feature, is reduced from \$180 to \$150 for minimum accommodations and the one-way fare from New York to San Juan is now \$65 instead of \$75. These reductions are permanent.

The Portland & New York Steamship Company has inaugurated a direct freight service between New York and Maine. This service was very much used by shippers and receivers for many years prior to its discontinuance in 1917.

TRADE PUBLICATIONS

ELECTRIC RIVET AND METAL HEATERS.—The story of the development and application of Berwick electric rivet heaters is contained in a well illustrated catalogue which the American Car and Foundry Company, New York, has recently published. Since 1912 the company has been experimenting with devices for heating rivets electrically and in November, 1919, machines for this purpose were perfected. Complete details of the various types and capacity heaters are given with comments from railroads, boiler shops and other shops where the heaters are used. Information is given on automatic heaters which are now being developed for heating bolt blanks, drop forgings, bar stock 20 to 30 feet in length of any cross sectional area from $\frac{3}{8}$ inch diameter up to $1\frac{1}{2}$ inches, for spot welding and the like. The company is also interested in developing electric heaters for practically any special requirement and will be glad to supply the catalogue on request.

BOILER TUBE THIMBLES.—A folder describing the method of installing boiler tube protection thimbles has recently been sent out by the American Boiler Tube Thimble Company, Providence, R. I.

COPPER AND BRASS.—The April bulletin of the Research Association of the Copper and Brass Industry, New York, contains information on the relative merits of copper and aluminum electric conductors. The subject of brass hardware and the use of brass pipe are taken up in detail.

FORTY YEARS OF PROGRESS.—The history of the forty years' growth of the Heine Boiler Company, St. Louis, Mo., and the announcement of the change of name from the Heine Safety Boiler Company and of the new control are given in a bulletin just sent out by the company. Various types of Heine boilers are also briefly described. It is the purpose of the company to extend the assistance of its facilities and engineering service to all those who design, erect and operate power plants in which Heine boilers are used.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers

Navy Department, Washington, D. C.
Secretary-Treasurer—Commander J. S. Evans,
U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers

29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers

29 West 39th Street, New York City.

United States Naval Institute

Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association

15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association

Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots

National Secretary—M. D. Tenniwood, 308 Vine St., Camden, N. J.

American Society of Marine Designers

Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass.

National Marine Engineers' Beneficial Association

Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association

1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association

11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association

149 Broadway, New York
President—C. H. Potter

CANADA

Grand Council N. A. of M. E. of Canada

Grand Secretary-Treasurer—Neil J. Morrison,
Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland

39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders

Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated

The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici
in Italia